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They're Only Nuclear Weapons: An Exploratory Analysis of Safety Climate within the Nuclear Enterprise

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THEY’RE ONLY NUCLEAR WEAPONS: AN EXPLORATORY STUDY OF SAFETY CLIMATE WITHIN THE NUCLEAR ENTERPRISE

THESIS

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Abstract

By possessing nuclear weapons, the United States Air Force is inherently exposed to extreme safety concerns. With multiple setbacks in recent years (e.g., unauthorized transport of nuclear weapons, cheating scandals, and career dissatisfaction), some have begun to wonder how safe the nuclear enterprise truly is. Building upon the concept of safety climate, this study explores safety climate constructs and trends associated with current nuclear maintenance safety climate survey data.

First, exploratory factor analysis is used to explore the underlying psychometric structure of the nuclear maintenance Air Force Combined Mishap Reduction System survey. Next, constructs extracted from the survey are compared across demographic variables in search of safety trends within the nuclear enterprise. Results confirm that a three-factor structure exists within survey data (consisting of Management Commitment, Resources, and Training constructs), and that differences in perceptions of these constructs exist across five of the seven explored variables (i.e., deployment to the intercontinental ballistic missile fields, rank, age, time in unit, and time in career field). Recommendations based on the findings are presented for leadership contemplation and action.

To my amazingly supportive wife, parents, and friends that give me the strength to achieve things I never dreamt were possible

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I would like to express my deepest gratitude for the endless patience and mentorship of Colonel Matthew Douglas. With his support I was able to tackle a topic that means a great deal to me, and hopefully, walk away a better officer and citizen than when I arrived. To the great friends I met here at AFIT, it was all of you that made the experience truly memorable. Finally, to the men and women of the Air Force nuclear enterprise, hopefully I have done right by you with this work.

Capt Brandon M. Clements

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THEY'RE ONLY NUCLEAR WEAPONS: AN EXPLORATORY STUDY OF SAFETY CLIMATE WITHIN THE NUCLEAR ENTERPRISE

I. Introduction

Overview

In 1945, the United States detonated the first nuclear weapon. Since that time, nuclear weapons have become a cornerstone of the United States' strategic policy. In 1959, intercontinental ballistic missiles and submarine-launched ballistic missiles were introduced, creating the foundations of what would become the "Nuclear Triad." Currently, the United States Air Force is responsible for the custody and use of two legs of this triad. Beginning in 2007, and continuing through 2014, the Air Force experienced a string of events that negatively affected the perception of enterprise-wide safety. These incidents ultimately shined a spotlight on possible safety deficiencies within the nuclear enterprise.

This thesis will focus on identifying constructs of safety climate that exist within the current nuclear maintenance safety survey developed by the Air Force Safety Center, and how the resultant information may be utilized by leaders to make decisions regarding safety climate. Chapter 1 will provide a background of recent incidents potentially affecting nuclear safety, introduce the concept of safety climate in relation to organizational behavior, and explain what data will be analyzed from the survey. Additionally, a research problem and related investigative questions will be presented. To conclude, future implications for nuclear enterprise leaders' decision making will be discussed.

Background

In 2007, the United States Air Force unknowingly flew six nuclear weapons from North Dakota to Louisiana, starting a chain of events that led to a top-down restructuring of the Air Forces' nuclear enterprise (Starr, 2007). During the 7 years following, the enterprise suffered multiple setbacks including wide-scale cheating by officers operating the weapon system, security failures, and career dissatisfaction by members within the nuclear enterprise (Burns & Baldor, 2014). With public opinion shifting negatively, Secretary of Defense Chuck Hagel funded two reports and increased nuclear related funding by $311 million for the 2015 and 2016 fiscal years (Shinkman, 2014)

Through initiatives like the Force Improvement Program, change came quickly and was introduced at all levels (Heikkinen, 2014; Pampe, 2014). Along with the negative events, these initiatives created rapid and widespread change that affected the day-to-day operations for both senior leadership and field level technicians alike, including an increased emphasis on implementing changes to increase safe operations in the nuclear career fields (McCullough, 2015). This emphasis coincided with a 2006 call by the Secretary of Defense to reduce mishaps across the Air Force by 75%. (AFSEC, n.d.-a)

A 30 year old idea may assist Air Force leadership in meeting the mishap reduction goal. In 1980, Dov Zohar proposed the idea that there was a subset of organizational climate specifically related to safety. Since his landmark study, a multitude of researchers have found relationships between organizations' safety climate and safety outcomes (Colley, Lincolne, & Neal, 2013). Knowledge of this relationship could be beneficial to decision-makers within the Air Force nuclear enterprise. Papers have been written about safety climate within hospitals (Singer, Lin, Falwell, Gaba, & Baker, 2009), industrial organizations (Choudhry, Fang, & Lingard, 2009), and nuclear power plants (Morrow, Kenneth Koves, & Barnes, 2014), but currently, relationships between safety climate and safety performance within the Air Force Nuclear Enterprise have not been adequately explored.

Air Force Combined Mishap Reduction System

One self-described "safety tool" that the Air Force utilizes is the Air Force Combined Mishap Reduction System (AFCMRS) (AFSEC, n.d.-a). The AFCMRS program is an assessment program that was instituted in response to the Secretary of Defense's 2003 goal of reducing mishaps by 50% (AFSEC, n.d.-a). AFCMRS is meant to provide commanders and supervisors with a predictive tool regarding safety and does so in the form of a 15 separate surveys. This research will focus on the Nuclear Mission Maintenance Survey (see Appendix A: AFSEC Survey Questionnaire). Each survey is meant to focus on a single component (including, but not limited to, operations, maintenance, and protective equipment usage) and relies on self-reported perceptions. Every survey utilizes either a 7 or 8-point Likert scale and, depending on the survey version, offers the ability to enter comments on each item as well as answering open ended questions. Questions are not uniform across all surveys and each is tailored by the Air Force Safety Center's Human Factors Division to focus on a single facet of safety.

Tasked with developing and maintaining measures to assess the Air Force safety culture, the Human Factors Division is responsible for the AFCMRS safety survey. (AFSEC, 2000) Staffed with experts from relevant fields within the Air Force (AFSEC,

2000) the Human Factors Division utilizes a theory-based approach to assess safety within the Air Force. With an understanding that human error is the largest cause of accidents (AFSEC, n.d.-b; Flin, Mearns, O'Connor, & Bryden, 2000; Shappell & Wiegmann, 2000) AFCMRS surveys focus on the human factors for risk mitigation efforts and uses the Human Factors Analysis and Classification System (HFACS) model as the explanatory basis for their endeavors (AFSEC, n.d.-b)

The HFACS model (see Figure 1) is built upon James Reason's "Swiss Cheese" model (Shappell & Wiegmann, 2000). Reason's model seeks to explain accidents and incidents as a sequential failure at multiple levels (Organizational influences, unsafe supervision, preconditions, and unsafe acts) and it is when all four of these levels fail that an accident will occur (Reason, 1990). The alignment of holes in the multiple levels (hence the "Swiss Cheese" moniker) allows for an accident to happen. In a similar vein, the HFACS model is built upon the assumption that accidents happen due to a causal relationship between multiple tiers, or defenses, and it is when failures occur at multiple levels that an accident occurs (Shappell & Wiegmann, 2000). This model drives the AFCMRS survey layout and developed measures are organized to align with the top two tiers of the HFACS model, Organizational Influences and Supervision (AFSEC, n.d.-b)

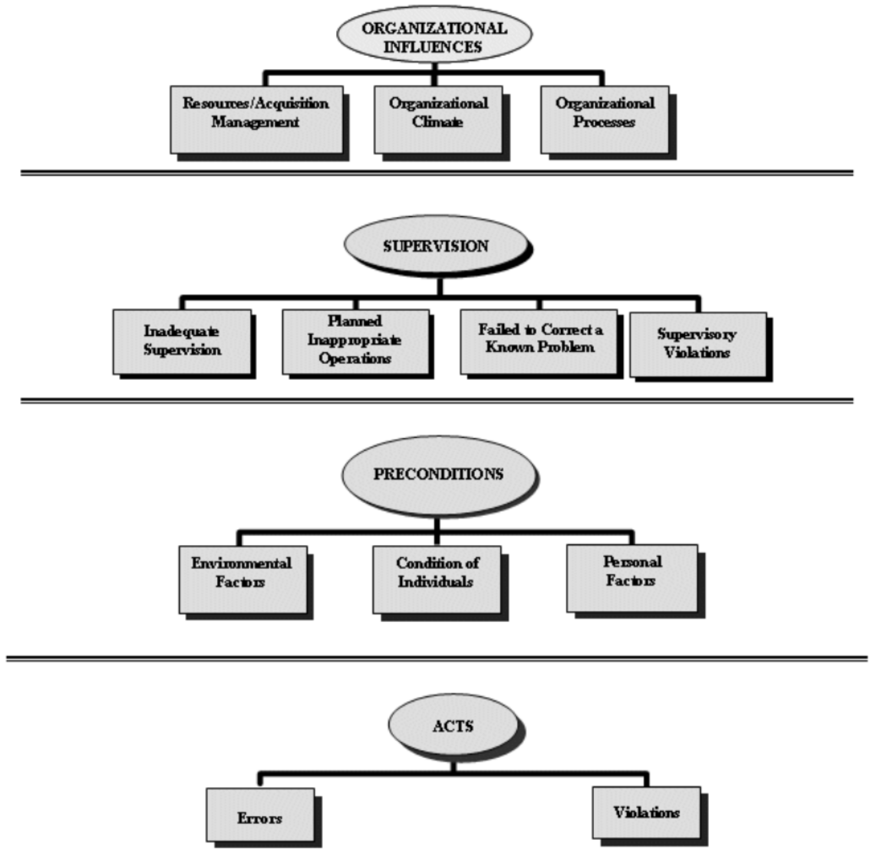

Figure 1. Human Factors Analysis and Classification System (HFACS) model (AFSEC, n.d.-b)

Research Question and Investigative Questions

The purpose of this study is to explore safety climate constructs within current nuclear maintenance safety climate survey, ultimately answering the research question: RQ: How can the data from Air Force nuclear maintenance safety climate survey be analyzed in order to better inform decision makers on the existing safety climate within the Air Force nuclear enterprise?

In pursuit of this purpose, the following investigative questions will be answered:

IQ1. What coherent safety climate (or other) constructs exist within the current nuclear maintenance Air Force Combined Mishap Reduction System survey data?

IQ2. What variables exist, within the existing survey, which may provide a basis for analysis of safety trends within the nuclear maintenance enterprise?

IQ3. What trends, differences, or similarities, exist among the identified constructs and variables that may highlight existing trends useful for leadership situational awareness and decision making?

Research Focus

This study will focus on all members of the Air Force nuclear maintenance enterprise. Safety climate data will be gleaned from the Air Force Safety Center's Combined Mishap Reduction System survey and incorporates responses from officers, enlisted, and civilian members. Survey data consists of responses from members of both intercontinental ballistic missile and nuclear-capable aircraft maintenance career fields and covers a time-in-service range from less than one month up to 20+ years of service.

Methodology

Utilizing well-established safety literature, the researcher created a framework of nine dimensions (later reduced to three), through which, the Combined Mishap Reduction System survey data were analyzed. Dimension definitions are discussed in detail within Chapter 3. Validity of the constructs was validated by a sample group of Air Force Institute of Technology faculty and students. Following substantive validation of dimensions, exploratory factor analysis (EFA), and one-way analysis of variance was performed to identify data-supported constructs and explore relationships among the identified constructs.

Assumptions and Limitations

This study is limited by the current language of the Air Force Combined Mishap Reduction System survey. At the time of analysis, survey questions were not focused on measuring any given construct and the researcher assigned proposed constructs after the fact. Additionally, due to non-attributional policy, historical mishap data could not be obtained. This eliminated the possibility of more adequately analyzing the relationship between climate and outcome.

Implications

Utilizing the findings of this research, senior leaders will be able to determine how well safety concepts diffuse to the tactical-level units. Defining relationships between variables like age, time in service, and career field will provide valuable insight with which leadership can make informed decisions regarding resource allocation. By understanding the constructs available within the available data, and the magnitude of those constructs within, and across groups, leadership may be able to proactively predict and avoid negative outcomes.

II Literature Review

Overview

This chapter will focus on the construct of safety climate and related concepts relevant to this research. To begin, research into the topic of safety climate will be identified and discussed. This review is followed by a discussion regarding commonly found themes within current academic research. After the content analysis, relevant dimensions within safety climate to be used for analysis will be defined.

Safety Climate

The idea of safety climate was originally proposed by Dov Zohar in 1980. Safety climate, Zohar hypothesized, was a sub-climate of organizational climate (Coyle, Sleeman, & Adams, 1995; Zohar, 1980). Using a 40-item safety measure, Zohar validated the existence of a measurable climate within factories exhibiting an eight factor structure (safety training, management attitudes, safety's effect on promotion, perceived risk, work pace, status of safety officer, effect on social status, and status of safety committee (Brown & Holmes, 1986)). Since his landmark study, safety climate research has continued across multiple industries and disciplines including, but not limited to, hospitals (Gershon et al., 2000), manufacturing facilities (R. L. Brown & Holmes, 1986; Johnson, 2007), and nuclear power plants (Carroll, 1998; Lee, 1998).

Zohar (1980) initially hypothesized that safety climate was the sum of shared employee perceptions regarding organizational safety. Future researchers further delineated the definition as shared perceptions "of the value of safety" within the organization (A. Neal, Griffin, & Hart, 2000) with the "value" encompassing perceptions relevant to the "policies, procedures, and practices" of the organization (Colley et al., 2013; A. Neal et al., 2000; Zohar, 2008). In a meta-analysis performed by Guldenmund (2000), 18 published works regarding safety climate and culture were compiled in search of a common theme within definitions. He found that safety climate was defined as "collective mental programming", "everyone feels responsible for safety", and "a… concept describing the safety ethics," but most shared the common thread of perception (Guldenmund, 2000). No matter the nuances in definition, perception is important because it is generally accepted, even before Zohar's research, that perception has a causal relationship with negative outcomes (Coyle et al., 1995).

As the influence of the safety climate has grown, so have the implications. In his earliest work, Zohar predicted that a facet-specific construct existed that included a shared view by employees, but his initial research stopped short of pontificating on possible uses for the discovered factors aside from a means to measure feelings of safety (R. L. Brown & Holmes, 1986). As acceptance grew for this proposed climate, research began to take multiple directions. Cooper and Phillips (2004) suggest that safety climate research branched into four main disciplines: (a) Designing instruments with which to measure and analyze factor structures; (b) Developing and testing theoretical models; (c) Examining causal relationships between safety climate and safety outcomes; and (d) Exploring the relationship between safety climate and the parent organizational climate

Research into the causal relationship between climate and outcomes has gained considerable traction in recent years. While Zohar did not include a predictive determination in his original works, researchers have since attempted to both validate his results (with little success) (Coyle et al., 1995) and explore a predictive capability of safety climate (with mixed success) (Choudhry et al., 2009). A 2014 study by Stephanie Morrow and colleagues successfully linked perceptions with performance indicators at a U.S. nuclear power plant (Morrow et al., 2014) and Stephen Johnson established a statistically significant correlation in his 2007 study revolving around 292 employees involved in heavy manufacturing (Johnson, 2007). While some have failed to establish a correlation (I. Glendon, 2016), the possibility of a construct with predictive capabilities could provide leading performance indicators allowing organizations to prevent negative outcomes.

Safety Outcomes

Safety outcomes are the results of an individual's decision to act safely or unsafely. Measured retroactively through accident rates and monetary impact (Cooper & Phillips, 2004), outcomes are reactive in nature and provide managers with no predictive capabilities. Because positive safety outcomes result in a more productive organization, leadership at all levels should be concerned with reducing and preventing negative outcomes. This is increasingly true for high-risk industries where day to day operations include inherent hazards with higher risk of negative safety outcomes (Flin et al., 2000; Garcia-Herrero, Mariscal, Gutiierrez, & Toca-Otero, 2013).

As research continues to strengthen the relationship between safety climate and safety outcomes, leaders can utilize safety climate as a predictive indicator of future safety performance. Throughout safety literature, researchers have found that employees are more apt to adhere to safe workplace practices if they perceive their organization places a high value on safety (Colley et al., 2013). Leading indicators have begun to replace lagging indicators as human factors are recognized to be responsible for more negative safety outcomes than technical shortfalls (Choudhry et al., 2009; Weick, Sutcliffe, & Obstfeld, 2008). This relationship can provide valuable insight to decision makers as determinants of safe work practices can be predictive in nature instead of lagging (Andrew Neal & Griffin, 2006).

Prevalent Dimensions

Many different scales have been utilized to measure safety climate. Zohar's seminal study utilized a 40-item measure (1980) to identify eight dimensions influencing safety climate (Williamson, Feyer, Cairns, & Biancotti, 1997), and since, measures have remained as varied as the industries that they studied. A 1986 attempt was made to confirm the results of Zohar's measure, but succeeded in only confirming three dimensions (Brown & Holmes, 1986). Williamson and colleagues (1997) point out that an attempt to replicate the Brown and Holmes study was unsuccessful and resulted in a further reduction to a two-facture structure (Dedobbeleer & Beland, 1991).Through a comprehensive review of academic works related to safety climate, Flin et al. (2000) found that measurement instruments ranged from 11 to 300 items and that dimensions within the construct of safety climate varied between 2 and 19 factors. Some of this wide variation can be accounted for by the career specificity of safety climate (Zohar, 2008) and differences in population demographics (R. L. Brown & Holmes, 1986)

Understanding that climate has multiple dimensions (Guldenmund, 2000) explains why such wide breadth of factors exists within research. Jones and James (1979) suggested that climate may consist of both core dimensions and dimensions applicable specifically to certain industries or studies, dependent upon hazards and expectations. Because of the wide variation of safety climate measures, commonality of factors is lacking within the field (Flin et al., 2000; Guldenmund, 2000) and both Flin and Guldenmund attempted to identify common dimensions that managers could use in the measurement of safety climate. Flin ultimately found that the most frequently occurring dimensions were management, safety systems, risk, work pressure, and competence, but argues against accepting those five as universal (Flin et al., 2000).

With a wide-range of dimensions proposed throughout literature, this study utilizes the following dimensions which exhibit a high frequency of occurrences within safety climate research: Management Action, Management Attitude, Safety v. Production, Resources, Status of Safety, Communication, Training, Active Supervisory Practice, and Perception of Risk. Table 1 below provides a matrix of chosen dimensions, along with how frequently they were mentioned, and provided the outline for dimension development for this study.

Table 1. Prevalent Dimensions in Safety Climate Research

Article	Prevalent Dimensions								
	MA	MB	SP	RE	SS	CM	TG	AS	PR
Brown & Holmes, 1986	X	X							X
Carroll, J., 1998	X	X				X	X		X
Colley et al., 2013	X	X		X		X	X	X	
Conchie et al., 2013		X				X	X	X	
Cooper & Phillips, 2004	X	X			X		X		X
Coyle et al., 1995	X	X		X			X	X	X
Dedobbeleer & Belland, 1991	X	X							
DeJoy, D. 2004		X				X			
Diaz & Cabrera, 1997	X	X	X						X
Donald & Canter, 1994	X	X							
Evans et al., 2007		X		X		X	X		
Flin et al., 2000		X	X	X			X		X
Huang et al., 2013 a		X	X					X	X
Huang et al., 2013 b		X		X		X	X	X	
Janssens et al., 1995	X		X						X
Lee, T., 1998		X					X	X	X
Mearns et al., 1997		X	X			X		X	X
Niskanen, T., 1994	X	X			X				
Ostrom et al., 1993				X		X	X	X	X
Phillips et al., 1993	X	X		X	X				X
Rundmo, T., 1992				X					X
Williamson et al., 1997								X	X
Zohar, D., 1980	X		X		X		X		X
Zohar & Luria, 2005	X	X	X				X	X	
Zohar, D., 2010	X				X		X		X

Note: MA - Management Attitude, MB - Management Action, SP - Safety v. Production, RE - Resources, SS - Status of Safety, CM - Communication, TG - Training, AS - Active Supervisory Practices, PR - Perceived Risk

Dimensions for this research were decided upon using a three-step process:

1. Beginning with Flin and colleagues (2000) meta-analysis of common safety climate dimension as a starting point, relevant literature was reviewed for themes, measures, and discussion regarding dimensions relevant to measuring or predicting safety climate.
2. Items relating to safety climate were extracted from articles and compiled into a list of 180 possibilities (see Appendix B). These items were references, measures, discussion points, citations, and concepts the author sought to research, measure, or included as research.
3. The researcher reviewed and aligned similar items, ultimately settling on nine constructs that incorporated the 180 snippets.

Management Attitude

Management Attitude is a dimension concerned with the perception of how management views safety. Acting as an encompassing dimensions, Management Attitude is holistic in that it includes organization concepts such as enacted policy (policy that is observed instead of explicitly stated (Zohar, 2008), encouragement of safe practices, and espousing safety values. From an employee standpoint, Management Attitude can be identified with the question "How concerned is management with employee well-being?" (Brown & Holmes, 1986). The subcomponent of safety values is particularly important as values may be espoused by supervisors, while also being tacitly observed by employees, both of which have a suggested causal relationship with safety behaviors (Conchie, Moon, & Duncan, 2013).

Management Action

Management action refers to the respondents' perceptions regarding actions taken by management. Common items associated with management action include formal policy regarding safety, rewarding and punishing for positive and negative safety practices, and supporting safety. In contrast to Management Attitude, Management Action is the individual perception of "How active is management in responding to concern?" (Brown & Holmes, 1986). It can be argued that measuring safety climate is, in and of itself, a way for management to measure employee perceptions and evaluation of actions taken by management (Kouabenan, Ngueutsa, & Mbaye, 2015).

Safety v. Production

Safety versus Production encompasses the perceptions of the relationship between safety and other competing organizational goals (Zohar & Luria, 2003). Competing goals include numerous organizational activities (i.e. production or efficiency (Mearns et al., 2013)) and that competition of goals influences employee perception. As perception influences risk-taking (Mearns et al., 2013) goal prioritization by organizations, both explicit and implicit, has an impact on safety climate. This organizational balancing act can prove to be difficult and can change depending on the situation (Carroll, 1998).

Status of Safety

The dimension Status of Safety encompasses the perception of the importance placed on entities creating, enforcing, or measuring safety policies. These entities include safety committees and safety officers (Donald & Canter, 1994; Zohar, 1980). For this research, the Safety Status construct will also include the influence of safety practices on social status of employees, another construct suggested by Zohar's (1980) eight-factor safety climate structure.

Communication

Communication is comprised of the perception of effectiveness of communication regarding safety (both upwards and downward). Using methods similar to this study (Exploratory Factor Analysis), communication has appeared as an underlying structure for the road construction industry (Glendon & Litherland, 2001) and in the off-shore oil industry (Mearns, Flin, Gordon, & Fleming, 1998). During open-ended interviews with nuclear power plant employees, Carroll (1998) noted that lack of communication was a concern as expectations were never clearly stated

Resources

For this research, Resources is defined as the perception of adequacy and functionality of resources necessary for safety (manpower, equipment, facilities). Throughout initial research, the concept of resources was explained through multiple contexts: Trucks and Equipment (Huang et al., 2013), Safety Systems (Colley et al., 2013), and Facilities (Ostrom, Wilhelmsen, & Kaplan, 1993). Huang's (2013) study suggested that providing the proper resources was an investment in employee safety. Colley and colleagues explored safety climate utilizing Neal et al.'s (2000) safety measure and suggested that providing a safe environment (providing needed resources) may correlate with achieving other goals.

Training

As a dimension, Training will relate to the perception of the importance and efficacy of safety training. As one of Dov Zohar's (1980) original dimensions, importance of safety training was stressed as a strong discriminator between companies with strong safety records and companies that were lacking. Within additional research, Colley et al (2013) stress the importance of training perception and relate that perception to lower incident rates. In the nuclear realm, Terence Lee performed a 1998 study at a nuclear power plant, treating training as characteristic of low accident plants and, for analysis, treated training as a major domain (Lee, 1998)

Active Supervisory Practice

Active Supervisory Practices relies on perception of first-line supervisory involvement and influence on safety procedures and practices. Research shows a strong correlation between a supervisor's ability to enforce safety and an that organization's ability to produce safe outcomes (Conchie et al., 2013). Conchie (2013) felt that supervisors were directly responsible for effective communication and safety coaching. This outlook is supported for nuclear career fields by John Carroll's (1998) work examining employee perceptions at a nuclear power plant where a major concern was supervisors incapable of effective coaching. This concern is relevant because, along with a strong positive influence, supervisors also possess the ability to negative impact safety outcomes (Conchie et al., 2013).

Perceived Risk

Perception of risk is used by this research as a somewhat all-encompassing dimension. Where safety climate literature proposed ideas not directly related to the aforementioned eight, the researcher attempted to create a dimension that could catch smaller ideas. Perceived risk was explicitly stated in a study of off-shore petroleum rigs (Rundmo, 1992) but was treated as a descendent. However, Rundmo (1992) did feel that perceived risk could be measured separately from actual risk. This concept is the basis for the catch-all definition of perceived risk and consolidated items like physical work environment (Colley et al., 2013), perceived risk (Flin et al., 2000; Mearns, Flin, Gordon, & Fleming, 2001), risks (Lee, 1998), and risk perception (Brown & Holmes, 1986). The dimension itself can be summed up as “How safe do employees feel?” (Brown & Holmes, 1986).

Summary

Safety climate is a shared perception of how people feel and may be a representation of how safe an organization is. Throughout literature, many dimensions have been proposed as common factors influencing safety climate and this research will adapt nine of those dimensions as a springboard for further analysis in an attempt to discover underlying factors within safety climate measures in the Air Force nuclear maintenance community.

III Methodology

Overview

This chapter focuses on the methods used to gather, define, and validate dimensions used to define research constructs, as well as the methods used to explore the research data. Dimensions used for the study were gathered through extensive literature review. Relevant items were further refined and adapted by the researcher to develop constructs drawn from the Air Force Combined Mishap Reduction System (AFCMRS) data provided by the Air Force Safety Center. Upon deciding upon relevant measures, each survey item (question) was validated for retention for further analysis. Once validated, Exploratory Factor Analysis was used to identify existing constructs within the data set, and assess their properties and magnitude across multiple groups.

Survey Data

Data for this research was provided by the Air Force Safety Center. The Safety Center manages the AFCMRS survey used in this study, which is a survey designed to assess personnel perceptions of safety within organizations. The survey items utilize a 5-point Likert scale ranging from "Strongly Agree" to "Strongly Disagree." The survey also includes two additional options for "Not Applicable" and "Don't Know" resulting in a scoring system of 2-6 for level of agreement, 1 for "Don't Know" and 0 for "Not Applicable."

Currently, 11 versions of the survey are available. Data provided by the Air Force Safety Center for this research is composed of the 65-item nuclear maintenance version of the survey. This version is specifically slated to measure safety in relation to Nuclear Surety and includes responses from career fields involved in the operation, maintenance, and support of the nuclear mission. Due to the scope of this study, survey participants operating outside of the nuclear surety environment, and AFCMRS surveys non-nuclear in nature, are not included.

Survey Demographics

The survey data obtained covered a timeframe of 96 months (15 June 2009 to 7 June 2017) and included 17,660 responses (see Table 2). Sixty-four unique organizations were identified by coding provided by the Air Force Safety Center.

Respondents included civilian employees (General Schedule and Federal Wage System), active duty enlisted members (grades E1-E9), active duty officers (grades O1-O6) and a smattering of other responses (federal civilian employees, warrant officers, cadets, and governmental contractors). Grades E4-E6 (n = 10471) were the largest respondent group, accounting for 59.3% of survey responses and when combined, enlisted responses (n = 16,462) accounted for 93.2% of responses. In comparison, officer (n = 582) respondents amassed 3.3% of responses. All civilian respondents were grouped into “other” (n = 616) and were responsible for 3.5% of data points.

Another data point of note is age. Five choices were given by the survey: Less than 21 years of age, 21-22 years, 23-24 years, 25-30 years, and over 30 years old. The largest response group was the over 30 group (n = 5335) with 30.2% of responses identifying with this age group. In contrast, the smallest group was the below 21 years old group (n = 1742) accounting for 9.9% of overall responses.

Table 2. Demographic Data for AFCMRS Survey Data

Rank	Frequency (n)	Cumulative %
E1-E3	4137	23.4%
E4-E6	10471	82.7%
E7-E8	1694	92.3%
E9	160	93.2%
O1-O3	422	95.6%
O4-O5	160	96.5%
Other	616	100.0%

Time in Career (years)	Frequency (n)	Cumulative %
<1	1549	8.8%
1-2	3457	28.3%
3-5	4422	53.4%
6-10	3443	72.9%
11-15	2275	85.8%
16-20	1427	93.8%
20+	1087	100.0%

Missile Field Deployer	Frequency (n)	Cumulative %
Yes	1204	6.8%
No	6669	44.6%

Primary Weapon System	Frequency (n)	Cumulative %
ICBM	5053	28.6%
Bomber	10044	85.5%
Other	2563	100.0%

Time in Unit	Frequency (n)	Cumulative %
<1 month	490	2.8%
1 to 3 months	545	5.9%
4 to 6 months	526	8.8%
7 to 12 months	2314	21.9%
13 to 24 months	3974	44.4%
2 to 5 years	6446	80.9%
6 to 10 years	1548	89.7%
11 to 20 years	558	92.9%
> 20 years	1259	100.0%

Age (years)	Frequency (n)	Cumulative %
<21	1742	9.9%
21-22	2708	25.2%
23-24	2711	40.5%
25-30	5164	69.8%
>30	5335	100.0%

Note: Demographics represent original data set provided by Air Force Safety Center

Time in career field and time in unit data were also gathered. Time in career field was measured with seven possible responses: Less than one year, 1-2 years, 3-5 years, 6-10 years, 11-15 years, 16-20 years, and greater than 20 years. The results indicated that 3-5 years' time in career field (n = 4422) led 1-2 years (n = 3457) and 6-10 years (n = 3443) with 25.0%, 19.6%, and 19.5% of responses, respectively. The smallest representation was the over 20 year group (n = 1087) with 6.2% followed by 16-20 years (n = 1427) and less than 1 year (n = 1549) with 8.1% and 8.8% respectively.

Time in unit data allowed the largest span of options with nine groups identified: less than 1 month, 1 to 3 months, 4 to 6 months, 7 to 12 months, 13 to 24 months, 2 to 5 years, 6 to 10 years, 11 to 20 years, and greater than 20 years. The largest swath of data comes from the 2 to 5 years in unit group (n = 6446) with 36.5% of respondents identifying that group. The top three are rounded out by 13 to 24 months (n = 3974) and 7 to 12 months (n = 2314) representing 22.5% and 13.1%, respectively, of overall responses. The smallest three groups, in rank order from smallest to largest, are less than 1 month (n = 490), 4 to 6 months (n = 526), and 1 to 3 months (n = 545) accounting for 2.8, 3.0, and 3.1% of items. Respondents with less than two years' time in unit (n = 7849) represented 44.4% of survey responses and alludes to young pool of respondents.

Starting in 2013, the Air Force Safety Center began to track whether respondents deployed to the Intercontinental Ballistic Missile complex in performance of their duties. Because of this question change, only 7,873 respondents can be identified by this demographic. For the data as a whole, missile field deployers (n = 1204) made up 6.8% of responses and non-deployers (n = 6669) accounted for 37.8%. Since 9,787 data points were collected before the inclusion of this question more sense can be made from looking at percentages following the new question. For 2013, and onward, survey data non-deployers (n = 6669) accounted for 84.7% responses and dwarfed deployer responses (n = 1204).

Along with missile field deployers and non-deployers, the AFCMRS survey gathers information regarding the primary weapon system maintained by the respondents. Choices available include: Bomber, Fighter/Attack, ICBM, Rescue, Special Duty, Tanker, Trainer, Transport, Unmanned Vehicles, and an option for "Not Applicable." The majority of respondents identified Bombers (n = 10,044) making up 56.9% of data points, with ICBMs (n = 5053) accounting for 28.6%. With small values, all other systems were combined into an “Other” category (n = 2563) and amounted to 14.5% of gathered data.

This sample serves as an adequate representation of manning within the nuclear enterprise. Utilizing data provided by the Air Force Personnel Center (AFPC), the ratio of logistics (somewhat synonymous with maintenance for the purposes of this section) personnel within the nuclear command (officers = 2.3%; enlisted = 97.7%) is exceptionally close to survey demographics with officer responses accounting for 3.4% of responses and enlisted responses covering the remaining 96.6% (Air Force Personnel Center, 2018a, 2018b). Anecdotally, the disparity between sample sizes for Weapon System is also an accurate reflection since units associated with bomber wings are more heavily manned than their ICBM counterparts. Additionally, Time in Unit accurately mirrors typical tour length with 80.9% of respondents reporting less than 5 years’ Time in Unit. In the author’s opinion, survey demographics provide an adequate representation of the career fields answering the AFCMRS survey.

Developing Dimensions

The AFCMRS survey consists of five predefined subsections: Organizational Processes, Organizational Climate, Resources, Supervision, and Open-ended response items. For the purposes of this research, the titles of these subsections were discarded and multiple survey items were deleted prior to validation. That is, three open-ended questions were excluded from this study because the purpose of this study was to conduct a quantitative analysis of the survey data. Nine items quantitative survey items were removed because the content did not relate to the purpose of this study. Specifically, deletion of items was based on three criteria:

1. The question relates to an organization besides the one to which most respondents belonged. (Major Command recognition programs adequately recognize my squadron/organization for outstanding nuclear security practices)
2. The question relates to a concept besides safety. (e.g. In my squadron/organization, everyone is responsible/accountable for nuclear security)
3. The question did not relate to any proposed dimension of safety climate (e.g. Maintenance records are correctly maintained, are accurate, and controlled in my squadron/organization.)

After elimination of irrelevant and out-of-scope items and open-ended items, 53 questions remained that were considered relevant to the study (see Appendix C: AFCMRS Measures retained for study).

Redefining the constructs was necessary due to the ambiguity of current measure structure. Current AFCMRS structure relies on the Human Factors Analysis and Classification System (HFACS) model (Shappell & Wiegmann, 2000). HFACS proposes that the majority of accidents can be attributed to human error and, by using this model, the AFCMRS survey considers two factors when categorizing data (Organizational and Supervisory influences) (AFSEC, n.d.-a). While relevant research does support a multi-level model for safety climate emphasizing group and organizational level influence

(Zohar & Luria, 2005) the author felt that exploring the psychometric structure of the data set would provide a more holistic approach to exploring the survey responses and possible constructs.

Safety Climate Dimensions

With little agreement on universal factors within the construct of safety climate (Flin et al, 2000), the author chose to rely on dimensions with a high rate of occurrence in similar studies. Drawing from 34 publications, 9 dimensions (see *Table 3*) were initially identified as common factors in safety climate research. Dimensions were chosen based on the number of occurrences within reviewed literature and occurrences referenced the dimension as important, utilized the dimension in a safety climate measure, or discussed the dimension's impact on safety climate. Following initial selection, these nine dimensions were subjected to a three-step process to determine relevance to the AFCMRS survey structure. First, discussion with two subject matter experts ensured suitability of proposed dimensions. Next, proposed dimensions underwent validation through a peer-review exercise. Lastly, dimensions were compared to underlying structure of data through principal component analysis.

Table 3. Occurrence Rate of Proposed Dimensions through Research

Construct	Occurrences
Management Attitude	24
Management Action	10
Percieved Risk	20
Training	17
Active supervisory practices	29
Safety v Production	8
Communication	11
Equipment & Facilities (Resources)	9
Status of Safety	15

Validating Dimensions

As this study is exploratory in nature, the assignment of dimensions required validation, both internal and external, prior to performing any type of quantitative analysis. In accordance with Anderson and Gerbing's procedure (1991), substantive validity of dimensions was evaluated through an "item-sort task" (Appendix D: Data Validation Exercise Instructions). The task consisted of a matching exercise through which participants were asked to match the 53 selected items with the most appropriate of the 9 preselected dimensions (see Appendix E). The test consisted of two versions (see Appendices F and G) which were randomly sorted using Microsoft Excel's "RAND" function. Initial content analysis was performed by one professor and one doctoral student familiar with the "item-sort task" method and safety climate theory in order to ensure proper content, formatting, and instruction. Feedback from both researchers was used to refine the exercise definitions and test composition. Following modification, substantive validity testing was performed on a sample group of 14 Air Force officers attending the Air Force Institute of Technology.

Survey item retention and assignment of survey items to dimensions was performed using Anderson and Gerbing's (1991) procedure. By calculating substantive validity coefficients (c_{sv}) for each survey item, the researcher could determine the strength of substantive validity of each dimension. The c_{sv} is calculated by:

$$c_{sv} = \frac{n_c - n_o}{N}$$

Where n_c is the number of respondents that assign the expected dimension to a survey item, n_o is the number of respondents that assign any other dimension to a survey item, and N is the total number of respondents. The researcher utilized c_{sv} as the ultimate decision-making device for both survey item retention and assignment of dimensions to each item, discarding measures with $c_{sv} < 0.50$.

Measure Retention

Following peer-validation testing of proposed dimensions, the author sought to purify the measure items provided by the Safety Center survey. 53 measures from the original AFCMRS survey were included on the peer-validation surveys. Of those items, only 21 met the required c_{sv} value and were retained for further analysis. Those measures are highlighted in Table 4.

Table 4. Summary of Substantive Validity Coefficients Following Validation

Measure	Hypothesized Construct	csv		Measure	Hypothesized Construct	csv
3	TG	0.500		38	PR	-0.250
6	TG	0.750		39	PR	-0.375
7	TG	1.000		40	RE	1.000
8	AS	0.625		41	RE	0.500
11	RE	1.000		42	RE	1.000
12	AS	-0.625		43	SP	0.000
14	MC	-0.750		44	SP	-0.250
15	MC	-0.250		45	SP	-0.500
16	SP	-0.375		46	SP	-0.625
17	MC	0.625		47	SP	-0.500
19	RE	0.000		48	SP	0.000
20	MC	-0.125		49	PR	-0.500
21	CM	1.000		50	PR	-0.250
22	CM	0.875		51	RE	0.875
25	MC	0.000		52	AS	-0.125
26	TG	-0.500		53	CM	0.750
27	PR	-0.875		54	AS	0.250
28	PR	-0.375		55	AS	0.250
29	MC	-0.125		56	MC	0.125
30	MC	0.000		57	MC	0.500
31	MC	-0.125		58	MC	0.250
32	PR	-0.500		59	MC	0.750
33	MC	0.625		60	MC	0.375
34	SS	0.500		61	MC	-0.250
35	SS	0.625		62	AS	0.500
36	SS	0.750		63	MC	0.750
37	PR	-0.500				

Dimension Refinement

At the conclusion of the item-sort task, the initial pool of nine suspected dimensions was reduced to six dimensions. Safety v. Production and Perceived risk were eliminated due to low substantive validity coefficients on assigned measures (highest c_{sv} of 0.00 and -0.25 respectively). Management Attitude and Management Action were combined to form a single dimension, Management Commitment. Respondents strongly agreed that the two dimensions were subtly different and retained measures could be further strengthened with the combination. Prior to combining the two dimensions, no proposed Management Attitude or Management Action measure garnered a c_{sv} of 0.50 or higher. Following the development of a Management Commitment dimension, five measures achieved required c_{sv} value. (Measures 10, 23, 47, 49, and 53). After refinement, the original 53 measures were further reduced and 21 measures were retained for further analysis (see Table 5).

Table 5. Number of Measures Assigned to Proposed Dimensions (Pre and Post-Validation)

Pre-Test			Post-Test	
Dimension	# of measures		Dimension	# of measures
Mgmt Attitude	7		Mgmt Commitment	5
Mgmt Action	7		Resources	5
Safety v. Production	7		Status of Safety	3
Resources	6		Training	3
Status of Safety	3		Communication	3
Training	4		Active Sup. Practices	2
Communication	4			
Active Sup. Practices	6			
Perceived Risk	9			
Total	53		Total	21

IV Analysis

Overview

This chapter will focus on data and analysis methods used in pursuit of the Research Question. All survey data was provided by the Air Force Safety Center. With an initial pool of 17,660 data points, a sample was randomly selected for analysis. The sample was conditioned to remove outliers and missing data. Conditioned data then underwent exploratory factor analysis to discover underlying factor structure. At the conclusion of multiple attempts, eliminating measures with excessive cross-loading or low communalities, three factors were discovered with Eigen values of greater than 1. With factor analysis complete, single-factor analysis was used to further illustrate differences between independent variables.

Data Selection and Conditioning

Research began with 17,660 survey responses, encompassing nine years of AFCMRS survey responses. Due to a survey question change occurring in 2013, all data prior to 30 July 2013 was excluded from further analysis. After this exclusion, 7,873 responses remained. To aid in factor analysis, a randomized 20% (n=1577) sample size was taken using Microsoft Excel's "RAND" function. Due to missing data, further conditioning was performed utilizing method's suggested by Hair and colleagues (Hair, Black, Babin, & Anderson, 2010).

"Not Applicable" and "Don't Know" answers were deleted and treated as missing data. Percentages of missing data were calculated for all measure items and survey respondents resulting in one question (Item 34) and 21 cases being deleted due to an abnormally high percentage. In accordance with Hair (2010), questions were deleted due to a missing data percentages exceeding 15% (Item 34 was 19.91%) and cases were deleted if missing data percentages were greater than 50%.

Following deletion of cases with excessive missing data, cases with uniform responses across all items were examined. At this point, an additional 173 cases were eliminated due to singularly uniform responses. Of the deleted cases, a vast majority of those were respondents that answered “5” for all questions (117 cases).

Once the researcher had eliminated singularly uniform cases, cases with excessive

Table 6. Item Mean Used to Replace Missing Data

Item	Mean	Std Dev
Personnel in my squadron/organization must possess the appropriate work experience and skills to receive qualifications	4.26	0.91
My training records are well maintained and accurate in my squadron/organization	4.23	0.81
I am adequately trained to competently conduct my job.	4.34	0.79
My squadron/organization adequately monitors daily operations to catch possible human errors	4.18	0.83
In my squadron/organization, required tools and equipment are available and serviceable	3.60	1.15
My squadron/organization adequately recognizes me or my subordinates for doing the correct procedures and maintenance	3.57	1.19
Within my squadron/organization, effective communication exists up and down the chain of command	3.46	1.25
My squadron/organization effectively communicates pertinent information during shift changes	3.69	1.09
Unprofessional behavior that compromises PRP standards is not tolerated in my squadron/organization	4.32	0.75
QA/QAE is a well respected element of my squadron/organization	3.67	1.13
QA/QAE positions are sought after in my squadron/organization	3.71	1.00
I am provided adequate resources (e.g., time, staffing, budget, and equipment) to accomplish my job	3.32	1.20
Day/Night crew has sufficient staffing to meet workload demands in my squadron/organization	3.34	1.21
My squadron/organization has adequate personnel to perform its current tasks	3.21	1.23
My squadron/organization has sufficient manning/assets to perform its current tasks	3.26	1.23
Leaders/Supervisors in my squadron/organization are successful in communicating mission goals to unit personnel	3.87	1.01
Leaders/Supervisors in my squadron/organization care for both members' quality of life and mission accomplishment	3.80	1.10
Leaders/Supervisors in my squadron/organization react well to unexpected changes	3.64	1.10
Supervisors encourage members in my squadron/organization to always complete work actions before signing off	4.31	0.77
Leadership in my squadron/organization encourages personnel to report incidents/accidents	4.33	0.76

missing data, and one item with excessive missing data, 1383 survey responses remained. For the remaining cases a mean-substitution method was utilized to account for missing data by calculating the mean response for all non-missing and substituting that mean in place of missing data (Hair et al., 2010) (see Table 6).

Exploratory Factor Analysis

For the purpose of exploring psychometric structure, Exploratory Factor Analysis (EFA) was utilized. EFA was chosen for the ability to analyze correlation between variables and establish factors for interrelated variables (Hair et al., 2010). The general rule is that sample size should be a 10:1 ratio (observations to variables) (Hair et al., 2010) and, with the supplied data set (n=1383) a ratio of 69.15:1 was achieved. Sampling adequacy was further confirmed with the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy of .947 (Kaiser, 1974). With sample size more than adequate the researcher used PASW Statistics 18 to perform all EFA iterations.

Initial EFA was performed with latent root criterion (eigenvalue > 1) to ensure sufficient correlations existed within provided variables. Bartlett's Test of Sphericity examines the entire correlation matrix for variables (Hair et al., 2010) and the obtained significance level (sig. < .01) enforces that sufficient correlations exist to validate the efficacy of EFA. The first principal component analysis provided four components that met latent root criterion with eigenvalues greater than 1, explaining a cumulative 66.4% of variance.

While the initial solution proved promising, examination of the factor loadings of each item suggested that component four explained little more variance (5.1%) than the first three components. Only two measures (NSMX_35 and NSMX_36) exceeded loadings of .5 for component four, so additional EFA was performed in search of the best possible structure. As recommended by Hair and colleagues (2010), best structure can be sought by exploring analysis with both one more, and one less, factors. Additional solutions were sought by enforcing a Principal Component Analysis with three components in lieu of Eigen values greater than one.

Eliminating component four and forcing only three components reduced the cumulative explained variance from 66.4% to 61.3%. As cumulative variance explained is acceptable for levels over 60% (Hair et al., 2010), three components still meet the rule-of-thumb. After ensuring data adequacy and cumulative variance, crossloading and communality (shared variance) (see Table *7*) were the next items of interest in deciphering the EFA. For ease of interpretation, factors were rotated using a Varimax rotation. The Varimax rotation is an orthogonal rotation and used with the assumption that components are uncorrelated (Hair et al., 2010). While other orthogonal rotations exist, Varimax often provides the strongest separation between components (Hair et al., 2010) and, assuming a structure exists amongst variables, most rotation methods will lead to similar results (J. D. Brown, 2009)

Table 7. Rotated Component Matrix: Initial Extraction with Varimax Rotation

Item	Component			Communality
	1	2	3	
NSMX_3			.687	.577
NSMX_6			.723	.600
NSMX_7			.725	.557
NSMX_8			.676	.626
NSMX_17		.541	.435	.539
NSMX_21	.553			.642
NSMX_22	.619	.418		.569
NSMX_35	.579			.496
NSMX_36	.503		.566	.375
NSMX_40	.630			.714
NSMX_41	.578			.747
NSMX_42		.745		.797
NSMX_51		.807		.760
NSMX_53		.860		.661
NSMX_57		.832		.687
NSMX_59	.709			.651
NSMX_11	.716			.515
NSMX_33	.701			.574
NSMX_62	.577		.483	.570
NSMX_63	.605		.488	.605
Eigenvalue	9.322	1.893	1.047	

Note: Factor loadings < .4 are supressed

Respecification of Factor Analysis

In order to further strengthen the structure, the author evaluated the loading and communality for all items. With factor loading values of .30 and higher considered acceptably significant (Hair et al., 2010), items that loaded to more than one component at .30 or higher were considered as cross-loading and evaluated for deletion. Additionally, communalities of less than .5 were considered for deletion as common variance is too low (Hair et al., 2010). Ultimately, five items met criteria for crossloading (NSMX_11, NSMX_21, NSMX_33, NSMX_62, and NSMX_63) and one item's (NSMX_36) communality fell below the threshold for acceptance.

Respecification of analysis occurred seven times (see Appendix H: EFA Respecification Varimax Rotated Component Matrices). Between each iteration, the researcher verified that all communalities remained above the selected tolerance and observed cross loading values. NSMX_36 was deleted first due to low communality. Deletion had a small effect on NSMX_35's communality, but little to no effect on other variables. Due to the reduced communality, NSMX 35 was deleted with no negative effect on other variable communalities. In order of deletion, the following variables were then removed due to significant cross loading: NSMX_33, NSMX_11, NSMX_62, and NSMX_63. Following the sixth iteration of EFA, a simple structure became apparent with 13 items loading singularly across 3 components (Table *8*).

Table 8. Rotated Component Matrix: Final Extraction with Varimax Rotation

Item	Component			Communality
	MC	RE	TG	
NSMX_3			.656	.599
NSMX_6			.756	.664
NSMX_7			.820	.706
NSMX_17	.696			.610
NSMX_21	.782			.744
NSMX_22	.721			.645
NSMX_40		.719		.705
NSMX_41		.817		.779
NSMX_42		.892		.858
NSMX_51		.847		.798
NSMX_53	.753			.679
NSMX_57	.778			.723
NSMX_59	.766			.693
Eigenvalue	6.723	1.505	0.975	
Cronbach's alpha	.906	0.905	0.72	

Note: MC - Management Commitment, RE - Resources, TG - Training. Factor loadings < .5 are supressed

Since data used for this analysis was composed of a five-point Likert scale, Cronbach's coefficient alpha was used to ensure reliability of the scale (Cooper & Phillips, 2004; Hair et al., 2010). Items were combined according to proposed component and analyzed using PASW Statistics 18's reliability analysis. Cronbach's alpha values of

.60 or greater are considered acceptable in exploratory research (Hair et al., 2010) and all three components exceeded this value (Component 1 - .906, Component 2 - .905, and Component 3 - .720)

Defining Components

A three-component structure was identified with the final iteration of EFA (see *Table 9*). Component 1 incorporated questions NSMX_17, NSMX_21, NSMX_22, NSMX_53, NSMX_57, and NSMX_59 with significant loadings, but differed slightly from originally proposed dimensions. Items NSMX_17, NSMX_57, and NSMX_59 were considered to correlate to Management Commitment and items NSMX_21, NSMX_22, and NSMX_53 were considered measurements associated with Communication. With a preponderance of previously discussed additional research focusing on the importance of Management Action as a key dimension of safety climate, the author felt comfortable incorporating Communication items under the dimension of Management Commitment for simplification of component definition. In addition, all three Communication items featured wording concerning management (squadron, organization, leaders, and supervisors) and their ability to properly communicate. For this purpose, the Communication dimension was incorporated into Management Commitment. Research by Evans, Glendon, and Creed (2007) attempted a similar study and identified a logical grouping between Management Commitment and Communication within the aviation industry, justifying their combination as a single factor.

Components 2 and 3 aligned with previously proposed dimensions. With a heavy loading from questions NSMX_40, NSMX_41, NSMX_42, and NSMX_51 (all originally assigned to the Resources dimension), it can safely be assumed that Component 2 is a measure of Resources. Likewise, Component 3 is comprised of three questions originally assumed to measure Training (NSMX_3, NSMX_6, and NSMX_7) and for future analysis was considered to measure the Training dimension.

Table 9. Rotated Component Matrix with Associated Questions

	Item	Component		
		MC	RE	TG
NSMX_17	My squadron/organization adequately recognizes me or my subordinates for doing the correct procedures and maintenance activities	.696		
NSMX_21	Within my squadron/organization, effective communication exists up and down the chain of command	.782		
NSMX_22	My squadron/organization effectively communicates pertinent information during shift changes	.721		
NSMX_53	Leaders/Supervisors in my squadron/organization are successful in communicating mission goals to unit personnel	.753		
NSMX_57	Leaders/Supervisors in my squadron/organization care for both members' quality of life and mission accomplishment	.778		
NSMX_59	Leaders/Supervisors in my squadron/organization react well to unexpected changes	.766		
NSMX_40	I am provided adequate resources (e.g., time, staffing, budget, and equipment) to accomplish my job		.719	
NSMX_41	Day/Night crew has sufficient staffing to meet workload demands in my squadron/organization		.817	
NSMX_42	My squadron/organization has adequate personnel to perform its current tasks		.892	
NSMX_51	My squadron/organization has sufficient manning/assets to perform its current tasks.		.847	
NSMX_3	Personnel in my squadron/organization must possess the appropriate work experience and skills to receive qualifications			.656
NSMX_6	My training records are well maintained and accurate in my squadron/organization			.756
NSMX_7	I am adequately trained to competently conduct my job			.820

Note: MC - Management Commitment, RE - Resources, TG- Training

For future analysis of means, all components were assigned composite scores associated with Management Commitment (MC), Resources (RC), and Training (TG). Each composite score was derived through a summation of item scores according to the item's primary loading. (I.e. individual item scores for questions NSMX_3, NSMX_6, and NSMX_7 were summed to create the composite score associated with TG for SPSS analysis). For the composite scores, higher scores indicated a higher positive perception of each component. Descriptive statistics are presented in Table *10*.

Table 10. Descriptive Statistics for Component Scores

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
MC	1383	6.00	30.00	22.0352	5.53381	30.623
RE	1383	4.00	20.00	13.1365	4.25813	18.132
TG	1383	3.00	15.00	12.8300	2.00223	4.009
Valid N (listwise)	1383					

ANOVA Results

Upon initial review, the data provided by the Air Force Safety Center included 13 potential groups for mean analysis (unit codenames, date completed, rank, missile field deployer status (does the individual deploy in support of the ICBM mission set?), age, time in career field, time in unit, work center, model aircraft, status (federal civilian or military), service status, primary weapon system, and branch of service). Of the provided data, two variables (work center and model of aircraft) were immediately excluded due to a lack of commonality in answers. Additionally, time to complete survey was deemed irrelevant to this study and was excluded. Individual unit information was not provided due to non-attributional polices regarding Air Force Safety Center data so that, along with participant numbers, was not put through any further analysis. After elimination, seven variables remained for further analysis (date completed, rank, missile field deployer status, age, time in career field, time in unit, and primary weapons system). With professional experience in the nuclear career field, the author deemed the remaining variables relevant for further exploration and proceeded with mean testing to explore trends between the retained variables.

Utilizing the three components developed from EFA (Management Commitment, Resources, and Training), the selected seven independent variables underwent mean testing via one-way analysis of variance (with PASW Statistics 18). Along with multiple comparison tests for each independent variable, homogeneity of variance assumptions were tested when statistically significant differences were found and, when homogeneity was lacking, two post hoc tests (Tukey Honest Significant Difference (HSD) and Dunnett T3) were conducted for comparisons. For tests with appropriate homogeneity, only the Tukey HSD post hoc test was conducted.

Missile Field Deployers

A one-way between subjects ANOVA was conducted to compare the effect of deployer status on perception of Management Commitment, perception of Training, and perception of Resources. There was a statistically significant difference between groups regarding Training ($F = 4.256$, $p < .039$) but no statistically significant difference between groups regarding Management Commitment ($F = .705$, $p < .401$) and Resources ($F = 1.136$, $p < .287$) (Table 11). The homogeneity of variance assumption for Management Commitment (Levene's test: $p = .108$) and Training (Levene's test: $p = .891$) were appropriate, while Resources was weak (Levene's test: $p = .007$) (Table 11). The mean perception of training score for deployers ($M = 12.55$, $SD = 2.06$) was significantly different, and lower, than non-deployers ($M = 12.87$, $SD = 1.99$) (Table 12).

Table 11. Missile Field Deployer: ANOVA and Homogeneity Results

		ANOVA					Homogeneity	
		Sum of Squares	df	Mean Square	F	Sig.	Levene Statistic	Sig.
MC	Between Groups	21.590	1	21.590	.705	.401	2.593	0.108
	Within Groups	42299.525	1381	30.630				
	Total	42321.115	1382					
RE	Between Groups	20.593	1	20.593	1.136	.287	7.311	0.007
	Within Groups	25037.390	1381	18.130				
	Total	25057.982	1382					
TG	Between Groups	17.023	1	17.023	4.256	.039	0.019	0.891
	Within Groups	5523.335	1381	4.000				
	Total	5540.358	1382					

Note : MC - Management Commitment, RE - Resources, TG - Training

Table 12. Missile Field Deployer: Composite Score Descriptives

		N	Mean	Std. Deviation	Std. Error	Interval for Mean Lower Bound	Interval for Mean Upper Bound	Minimum	Maximum
MC	Deployer	190	21.7221	5.12608	.37189	20.9886	22.4557	6.00	30.00
	Non-deployer	1193	22.0851	5.59641	.16203	21.7672	22.4030	6.00	30.00
	Total	1383	22.0352	5.53381	.14880	21.7433	22.3271	6.00	30.00
RE	Deployer	190	12.8308	3.78987	.27495	12.2884	13.3731	4.00	20.00
	Non-deployer	1193	13.1852	4.32749	.12529	12.9394	13.4310	4.00	20.00
	Total	1383	13.1365	4.25813	.11450	12.9119	13.3612	4.00	20.00
TG	Deployer	190	12.5520	2.06139	.14955	12.2570	12.8470	4.00	15.00
	Non-deployer	1193	12.8743	1.98995	.05761	12.7612	12.9873	3.00	15.00
	Total	1383	12.8300	2.00223	.05384	12.7244	12.9356	3.00	15.00

Note : MC - Management Commitment, RE - Resources, TG - Training

Primary Weapon System

For statistical analysis, conditions were divided among three groups: ICBMs (n = 377), Bombers (n = 877), and Other (n = 129). Other is comprised of all answers not specifically ICBM or bomber and includes, but is not limited to, tankers, transports, and fighter aircraft. This simplification was made to ensure an appropriate sample size, as all other systems accounted for only 130 data points of the 1383 within the sample.

A one-way between subjects ANOVA was conducted to compare the effect of the conditions (primary weapon system affiliation) on perception of Management

Commitment, perception of Training, and perception of Resources. There was no statistically significant difference between treatments' effect regarding Management Commitment (F=2.095, p < .123), Resources (F=2.875, p < .057), or Training (F=1.432, p <.239). (see Table *13*)

Homogeneity of variance assumptions were strong for all three components; Management Commitment (Levene's test: p = .672), Resources (Levene's test: p = .532), and Training (Levene's test: p = .871).

Although no statistically significant difference was reported between conditions for Resources (F=2.875, p < .057), post hoc tests (Tukey HSD) (see Table 14) identified statistically significant differences between ICBM (M = 22.32, SD = 5.46) and Other (M: 13.917, SD: 4.41) (see Table 14) regarding perception of Resources at p < .044. However no significant difference existed between Bombers (M: 13.13, SD: 4.26) and ICBMS or Other (Table 15).

Table 13. Primary Weapon System: ANOVA and Homogeneity Results

		ANOVA					Homogeneity	
		Sum of Squares	df	Mean Square	F	Sig.	Levene Statistic	Sig.
MC	Between Groups	128.098	2	64.049	2.095	.123	0.398	0.672
	Within Groups	42193.017	1380	30.575				
	Total	42321.115	1382					
RE	Between Groups	103.975	2	51.988	2.875	.057	0.631	0.532
	Within Groups	24954.007	1380	18.083				
	Total	25057.982	1382					
TG	Between Groups	11.472	2	5.736	1.432	.239	0.138	0.871
	Within Groups	5528.886	1380	4.006				
	Total	5540.358	1382					

Note: MC - Management Commitment, RE - Resources, TG - Training

Table 14. Primary Weapon System: Composite Score Descriptives

Descriptives

		N	Mean	Std. Deviation	Std. Error	Interval for Mean Lower Bound	Interval for Mean Upper Bound	Minimum	Maximum
MC	ICBM	377	22.3184	5.46014	.28121	21.7655	22.8714	6.00	30.00
	Bomber	877	21.8166	5.55382	.18754	21.4485	22.1847	6.00	30.00
	Other	129	22.6937	5.56437	.48992	21.7244	23.6631	9.00	30.00
	Total	1383	22.0352	5.53381	.14880	21.7433	22.3271	6.00	30.00
RE	ICBM	377	12.8788	4.16895	.21471	12.4566	13.3010	4.00	20.00
	Bomber	877	13.1323	4.26399	.14398	12.8497	13.4149	4.00	20.00
	Other	129	13.9187	4.41229	.38848	13.1500	14.6874	4.00	20.00
	Total	1383	13.1365	4.25813	.11450	12.9119	13.3612	4.00	20.00
TG	ICBM	377	12.7725	1.99967	.10299	12.5700	12.9750	4.00	15.00
	Bomber	877	12.8137	1.99058	.06722	12.6818	12.9457	3.00	15.00
	Other	129	13.1083	2.08097	.18322	12.7458	13.4709	3.00	15.00
	Total	1383	12.8300	2.00223	.05384	12.7244	12.9356	3.00	15.00

Note: MC - Management Commitment, RE - Resources, TG - Training

Table 15. Primary Weapon System: Post-Hoc Analysis

Multiple Comparisons

Dependent Variable		(I) Primary Weapons System	(J) Primary Weapons System	Mean Difference (I-J)	Std. Error	Sig.	Interval Lower Bound	Interval Upper Bound
MC	Tukey HSD	ICBM	Bomber	.50184	.34053	.304	-.2971	1.3008
			Other	-.37531	.56401	.784	-1.6986	.9480
		Bomber	ICBM	-.50184	.34053	.304	-1.3008	.2971
			Other	-.87714	.52142	.212	-2.1005	.3462
		Other	ICBM	.37531	.56401	.784	-.9480	1.6986
			Bomber	.87714	.52142	.212	-.3462	2.1005
RE	Tukey HSD	ICBM	Bomber	-.25343	.26188	.597	-.8679	.3610
			Other	-1.03988	.43375	.044	-2.0576	-.0222
		Bomber	ICBM	.25343	.26188	.597	-.3610	.8679
			Other	-.78645	.40099	.122	-1.7273	.1544
		Other	ICBM	1.03988	.43375	.044	.0222	2.0576
			Bomber	.78645	.40099	.122	-.1544	1.7273
TG	Tukey HSD	ICBM	Bomber	-.04121	.12327	.940	-.3304	.2480
			Other	-.33582	.20417	.227	-.8148	.1432
		Bomber	ICBM	.04121	.12327	.940	-.2480	.3304
			Other	-.29461	.18875	.263	-.7375	.1482
		Other	ICBM	.33582	.20417	.227	-.1432	.8148
			Bomber	.29461	.18875	.263	-.1482	.7375

Note: MC - Management Commitment, RE - Resources, TG - Training

Rank

For the rank variable, two data points were removed from the analysis due to a lack of conformity. Both data points identified as Warrant Officers and the sample size was deemed too small to be relevant. Additionally, all civilian grades were combined into a single dummy variable. Conditions were composed of seven groups: E1- E3 ($n = 294$), E4-E6 ($n = 836$), E7-E8 ($n = 155$), E9 ($n = 15$), O1-O3 ($n = 40$), O4-O5 ($n = 13$), and Civilian ($n = 30$) (see Table 16). For this random sample, no respondents possessed a rank above O5. Additionally, Civilian was comprised of all federal civilians regardless of pay grade identified in order to produce a more statistically relevant sample size.

A one-way between subjects ANOVA was conducted to compare the effect of seven conditions (rank) on perception of Management Commitment, perception of Training, and perception of Resources. There was a statistically significant difference regarding rank's effect on all three components: Management commitment ($F= 21.318$, $p < 0.001$), Resources ($F= 17.721$, $p < 0.001$), and Training ($F= 4.901$, $p < 0.001$) (see Table 17).

Homogeneity of variance assumptions were weak for Management Commitment (Levene's test: $p < .001$) and Training (Levene's test: $p < .001$), but acceptable for Resources (Levene's test: $p < .056$) (see Table 17) so both Tukey HSD and Dunnett T3 post hoc tests were conducted.

Table 16. Rank: Composite Score Descriptive Statistics

		N	Mean	Std. Deviation	Std. Error	Interval for Mean Lower Bound	Interval for Mean Upper Bound	Minimum	Maximum
MC	E1-E3	294	24.1744	4.96886	.28979	23.6041	24.7448	6.00	30.00
	E4-E6	836	20.8213	5.60467	.19384	20.4408	21.2018	6.00	30.00
	E7-E8	155	23.3802	4.86403	.39069	22.6084	24.1520	6.00	30.00
	E9	15	23.6458	4.84006	1.24970	20.9655	26.3262	14.00	30.00
	O1-O3	40	24.1172	4.08230	.64547	22.8116	25.4228	14.00	30.00
	O4-O5	13	28.3846	2.14237	.59419	27.0900	29.6792	25.00	30.00
	Civilian	30	21.6174	4.47973	.81788	19.9446	23.2902	12.00	28.00
	Total	1383	22.0352	5.53381	.14880	21.7433	22.3271	6.00	30.00
RE	E1-E3	294	15.2733	3.75680	.21910	14.8421	15.7045	4.00	20.00
	E4-E6	836	12.5828	4.26239	.14742	12.2934	12.8722	4.00	20.00
	E7-E8	155	12.5753	4.06580	.32657	11.9302	13.2205	4.00	20.00
	E9	15	11.8894	3.67668	.94931	9.8533	13.9254	4.00	17.00
	O1-O3	40	11.6927	3.81979	.60396	10.4711	12.9143	4.00	20.00
	O4-O5	13	14.6154	4.35007	1.20649	11.9867	17.2441	8.00	20.00
	Civilian	30	12.4348	3.82362	.69809	11.0070	13.8625	5.00	20.00
	Total	1383	13.1365	4.25813	.11450	12.9119	13.3612	4.00	20.00
TG	E1-E3	294	17.6173	2.34108	.13653	17.3485	17.8860	8.00	20.00
	E4-E6	836	16.7300	2.68052	.09271	16.5480	16.9119	4.00	20.00
	E7-E8	155	17.2238	2.45098	.19687	16.8349	17.6127	4.00	20.00
	E9	15	17.3749	2.20534	.56942	16.1536	18.5962	12.00	20.00
	O1-O3	40	16.9659	2.50682	.39636	16.1642	17.7677	10.00	20.00
	O4-O5	13	19.2308	1.09193	.30285	18.5709	19.8906	17.00	20.00
	Civilian	30	16.8137	3.28124	.59907	15.5884	18.0389	4.00	20.00
	Total	1383	17.0131	2.61060	.07020	16.8754	17.1508	4.00	20.00

Table 17. Rank: ANOVA and Homogeneity Results

		ANOVA Sum of Squares	df	Mean Square	F	Sig.	Homogeneity Levene Statistic	Sig.
MC	Between Groups	3599.380	6	599.897	21.318	.000	5.484	0.000
	Within Groups	38721.735	1376	28.141				
	Total	42321.115	1382					
RE	Between Groups	1797.373	6	299.562	17.721	.000	2.049	0.056
	Within Groups	23260.610	1376	16.905				
	Total	25057.982	1382					
TG	Between Groups	115.923	6	19.321	4.901	.000	3.651	0.001
	Within Groups	5424.435	1376	3.942				
	Total	5540.358	1382					

Note: MC - Management Commitment, RE - Resources, TG - Training

For the Management Commitment component, post hoc comparison (Dunnett T3) (Table 18) revealed statistically significant differences between the mean score of E1-E3 (M = 24.17, SD = 4.97) and both E4-E6 (M = 20.82, SD = 5.60) and O4-O5 (M = 28.38, SD = 2.14) on perception of Management Commitment. Furthermore, statistically significant differences exists between the mean scores for E4-E6 (M = 20.82, SD = 5.60) and E7-E8 (M = 23.38, SD = 4.86), O1-O3 (M = 24.12, SD = 4.08), and O4-O5 (M = 28.38, SD = 2.14). In addition to E4-E6, E7-E8's (M = 23.38, SD = 4.86) mean score was statistically significantly different from O4-O5 (M = 23.38, SD = 4.86). No statistically significant difference in means was discovered for E9 mean response (M = 23.65, SD = 4.84) in comparison to the six other conditions. One more statistically significant difference in means was found for O1-O3 (M = 23.38, SD = 4.86) when compared to O4-O5 (M = 23.38, SD = 4.86). The composite score for O4-O5 shares a statistically significant difference in mean with Civilian (M = 21.62, SD = 4.48).

Table 18. Rank: Post-Hoc Analysis (Management Commitment)

Dependent Variable		(I) Rank	(J) Rank	Mean Difference (I-J)	Std. Error	Sig.	Interval Lower Bound	Interval Upper Bound
MC	Dunnett T3	E1-E3	E4-E6	3.35315	.34864	.000	2.2920	4.4143
			E7-E8	.79427	.48643	.894	-.6912	2.2798
			E9	.52860	1.28286	1.000	-4.0097	5.0669
			O1-O3	.05724	.70754	1.000	-2.1819	2.2964
			O4-O5	-4.21018	.66109	.000	-6.4949	-1.9255
			Civilian	2.55703	.86771	.104	-.2521	5.3662
		E4-E6	E1-E3	-3.35315	.34864	.000	-4.4143	-2.2920
			E7-E8	-2.55888	.43613	.000	-3.8943	-1.2235
			E9	-2.82455	1.26464	.480	-7.3386	1.6895
			O1-O3	-3.29591	.67395	.000	-5.4481	-1.1437
			O4-O5	-7.56333	.62501	.000	-9.7941	-5.3326
			Civilian	-.79612	.84054	1.000	-3.5414	1.9492
		E7-E8	E1-E3	-.79427	.48643	.894	-2.2798	.6912
			E4-E6	2.55888	.43613	.000	1.2235	3.8943
			E9	-.26567	1.30934	1.000	-4.8429	4.3115
			O1-O3	-.73703	.75450	1.000	-3.1038	1.6297
			O4-O5	-5.00445	.71112	.000	-7.3852	-2.6237
			Civilian	1.76276	.90641	.671	-1.1423	4.6678
		E9	E1-E3	-.52860	1.28286	1.000	-5.0669	4.0097
			E4-E6	2.82455	1.26464	.480	-1.6895	7.3386
			E7-E8	.26567	1.30934	1.000	-4.3115	4.8429
			O1-O3	-.47136	1.40655	1.000	-5.2306	4.2879
			O4-O5	-4.73878	1.38376	.050	-9.4738	-.0038
			Civilian	2.02843	1.49355	.969	-2.9347	6.9916
		O1-O3	E1-E3	-.05724	.70754	1.000	-2.2964	2.1819
			E4-E6	3.29591	.67395	.000	1.1437	5.4481
			E7-E8	.73703	.75450	1.000	-1.6297	3.1038
			E9	.47136	1.40655	1.000	-4.2879	5.2306
			O4-O5	-4.26742	.87732	.000	-7.0926	-1.4423
			Civilian	2.49979	1.04190	.322	-.7897	5.7893
		O4-O5	E1-E3	4.21018	.66109	.000	1.9255	6.4949
			E4-E6	7.56333	.62501	.000	5.3326	9.7941
			E7-E8	5.00445	.71112	.000	2.6237	7.3852
			E9	4.73878	1.38376	.050	.0038	9.4738
			O1-O3	4.26742	.87732	.000	1.4423	7.0926
			Civilian	6.76721	1.01094	.000	3.5144	10.0200
		Civilian	E1-E3	-2.55703	.86771	.104	-5.3662	.2521
			E4-E6	.79612	.84054	1.000	-1.9492	3.5414
			E7-E8	-1.76276	.90641	.671	-4.6678	1.1423
			E9	-2.02843	1.49355	.969	-6.9916	2.9347
			O1-O3	-2.49979	1.04190	.322	-5.7893	.7897
			O4-O5	-6.76721	1.01094	.000	-10.0200	-3.5144

Table 19. Rank: Post-Hoc Analysis (Resources)

Dependent Variable		(I) Rank	(J) Rank	Mean Difference (I-J)	Std. Error	Sig.	Interval Lower Bound	Interval Upper Bound
RE	Tukey HSD	E1-E3	E4-E6	2.69047	.27878	.000	1.8673	3.5136
			E7-E8	2.69794	.40812	.000	1.4929	3.9030
			E9	3.38390	1.08833	.031	.1704	6.5974
			O1-O3	3.58059	.69290	.000	1.5347	5.6265
			O4-O5	.65788	1.16527	.998	-2.7828	4.0986
			Civilian	2.83851	.78802	.006	.5117	5.1653
		E4-E6	E1-E3	-2.69047	.27878	.000	-3.5136	-1.8673
			E7-E8	.00748	.35956	1.000	-1.0542	1.0691
			E9	.69344	1.07107	.995	-2.4691	3.8560
			O1-O3	.89012	.66546	.834	-1.0748	2.8550
			O4-O5	-2.03258	1.14916	.570	-5.4257	1.3605
			Civilian	.14804	.76401	1.000	-2.1078	2.4039
		E7-E8	E1-E3	-2.69794	.40812	.000	-3.9030	-1.4929
			E4-E6	-.00748	.35956	1.000	-1.0691	1.0542
			E9	.68596	1.11177	.996	-2.5968	3.9687
			O1-O3	.88265	.72916	.890	-1.2703	3.0356
			O4-O5	-2.04006	1.18719	.604	-5.5455	1.4653
			Civilian	.14057	.82009	1.000	-2.2809	2.5620
		E9	E1-E3	-3.38390	1.08833	.031	-6.5974	-.1704
			E4-E6	-.69344	1.07107	.995	-3.8560	2.4691
			E7-E8	-.68596	1.11177	.996	-3.9687	2.5968
			O1-O3	.19669	1.24482	1.000	-3.4789	3.8723
			O4-O5	-2.72602	1.55798	.582	-7.3263	1.8742
			Civilian	-.54540	1.30017	1.000	-4.3844	3.2936
		O1-O3	E1-E3	-3.58059	.69290	.000	-5.6265	-1.5347
			E4-E6	-.89012	.66546	.834	-2.8550	1.0748
			E7-E8	-.88265	.72916	.890	-3.0356	1.2703
			E9	-.19669	1.24482	1.000	-3.8723	3.4789
			O4-O5	-2.92271	1.31262	.282	-6.7985	.9531
			Civilian	-.74208	.99302	.990	-3.6742	2.1900
		O4-O5	E1-E3	-.65788	1.16527	.998	-4.0986	2.7828
			E4-E6	2.03258	1.14916	.570	-1.3605	5.4257
			E7-E8	2.04006	1.18719	.604	-1.4653	5.5455
			E9	2.72602	1.55798	.582	-1.8742	7.3263
			O1-O3	2.92271	1.31262	.282	-.9531	6.7985
			Civilian	2.18062	1.36522	.684	-1.8505	6.2117
		Civilian	E1-E3	-2.83851	.78802	.006	-5.1653	-.5117
			E4-E6	-.14804	.76401	1.000	-2.4039	2.1078
			E7-E8	-.14057	.82009	1.000	-2.5620	2.2809
			E9	.54540	1.30017	1.000	-3.2936	4.3844
			O1-O3	.74208	.99302	.990	-2.1900	3.6742
			O4-O5	-2.18062	1.36522	.684	-6.2117	1.8505

For the Resources component, post hoc comparison (Tukey HSD)(Table 19) revealed statistically significant differences between the mean score of E1-E3 (M = 15.27, SD = 3.76) and E4-E6 (M = 12.58, SD = 4.26), E7-E8 (M = 12.58, SD = 4.07), E9 (M = 11.89, SD = 3.68), O1-O3 (M = 11.69, SD = 3.82), and Civilian (M = 12.43, SD = 3.82). There was no significant difference between means for E1-E3 (M = 15.27, SD = 3.76) and O4-O5 (M = 14.62, SD = 4.35). E4-E6, E7-E8, E-9, and Civilians had no statistically significant difference in mean between any other conditions besides E1-E3.

For the Training component, post hoc comparison (Dunnett T3)(Table *20*) revealed that O4-O5 (M = 14.46, SD = .78) was the standout with a statistically significant composite score mean difference between E1-E3 (M = 13.23, SD = 1.78), E4-E6 (M = 12.65, SD = 2.06), E7-E8 (M = 12.97, SD = 1.88), O1-O3 (M = 12.57, SD = 2.09), and Civilian (M = 12.74, SD = 2.52). The only nonsignificant difference occurred when compared to E9 (M = 13.11, SD = 1.72). A statistically significant difference in means was discovered between E1-E3 (M = 13.23, SD = 1.78) and E4-E6 (M = 12.65, SD = 2.06) and no significant difference in means was revealed between E9 and any other condition.

Table 20. Rank: Post-Hoc Analysis (Training)

Multiple Comparisons

Dependent Variable		(I) Rank	(J) Rank	Mean Difference (I-J)	Std. Error	Sig.	Interval Lower Bound	Interval Upper Bound
TG	Dunnett T3	E1-E3	E4-E6	.57646	.12609	.000	.1927	.9602
			E7-E8	.25313	.18347	.977	-.3074	.8137
			E9	.11877	.45514	1.000	-1.4907	1.7282
			O1-O3	.69066	.34701	.635	-.4166	1.7979
			O4-O5	-1.23452	.23911	.001	-2.0616	-.4074
			Civilian	.48611	.47211	.999	-1.0570	2.0292
		E4-E6	E1-E3	-.57646	.12609	.000	-.9602	-.1927
			E7-E8	-.32333	.16707	.680	-.8351	.1884
			E9	-.45769	.44878	.997	-2.0587	1.1433
			O1-O3	.11420	.33862	1.000	-.9720	1.2004
			O4-O5	-1.81098	.22677	.000	-2.6197	-1.0023
			Civilian	-.09035	.46598	1.000	-1.6195	1.4388
		E7-E8	E1-E3	-.25313	.18347	.977	-.8137	.3074
			E4-E6	.32333	.16707	.680	-.1884	.8351
			E9	-.13436	.46815	1.000	-1.7634	1.4947
			O1-O3	.43753	.36390	.993	-.7138	1.5889
			O4-O5	-1.48765	.26304	.000	-2.3617	-.6136
			Civilian	.23298	.48466	1.000	-1.3395	1.8055
		E9	E1-E3	-.11877	.45514	1.000	-1.7282	1.4907
			E4-E6	.45769	.44878	.997	-1.1433	2.0587
			E7-E8	.13436	.46815	1.000	-1.4947	1.7634
			O1-O3	.57189	.55310	.998	-1.2424	2.3862
			O4-O5	-1.35329	.49262	.198	-3.0367	.3301
			Civilian	.36734	.63905	1.000	-1.6943	2.4290
		O1-O3	E1-E3	-.69066	.34701	.635	-1.7979	.4166
			E4-E6	-.11420	.33862	1.000	-1.2004	.9720
			E7-E8	-.43753	.36390	.993	-1.5889	.7138
			E9	-.57189	.55310	.998	-2.3862	1.2424
			O4-O5	-1.92518	.39489	.000	-3.1815	-.6689
			Civilian	-.20455	.56714	1.000	-1.9999	1.5908
		O4-O5	E1-E3	1.23452	.23911	.001	.4074	2.0616
			E4-E6	1.81098	.22677	.000	1.0023	2.6197
			E7-E8	1.48765	.26304	.000	.6136	2.3617
			E9	1.35329	.49262	.198	-.3301	3.0367
			O1-O3	1.92518	.39489	.000	.6689	3.1815
			Civilian	1.72064	.50834	.033	.0803	3.3610
		Civilian	E1-E3	-.48611	.47211	.999	-2.0292	1.0570
			E4-E6	.09035	.46598	1.000	-1.4388	1.6195
			E7-E8	-.23298	.48466	1.000	-1.8055	1.3395
			E9	-.36734	.63905	1.000	-2.4290	1.6943
			O1-O3	.20455	.56714	1.000	-1.5908	1.9999
			O4-O5	-1.72064	.50834	.033	-3.3610	-.0803

Note: MC - Management Commitment, RE - Resources, TG - Training

Age

A one-way between subjects ANOVA was conducted to compare the effect of five age conditions: <21 (n = 124), 21-22 (n = 176), 23-24 (n = 214), 25-30 (n = 398), and >30 (n = 471) (see *Table 21*) on perception of Management Commitment, perception of Training, and perception of Resources. There was a statistically significant difference regarding age's effect on all three components: Management Commitment ($F= 16.389$, $p < 0.001$), Resources ($F= 18.304$, $p < 0.001$), and Training ($F= 3.361$, $p < 0.010$). (*Table 22*)

Homogeneity of variance assumptions for Management Commitment (Levene's test: $p < .001$), Resources (Levene's test: $p < .001$), and Training (Levene's test: $p < .002$) were tenuous and, as such, both proposed post hoc tests were conducted with Dunnett T3 used for comparison

Table 21. Age: Composite Score Descriptive Statistics

		N	Mean	Std. Deviation	Std. Error	Interval for Mean Lower Bound	Interval for Mean Upper Bound	Minimum	Maximum
MC	<21	124	24.8771	4.20655	.37776	24.1293	25.6248	16.00	30.00
	21-22	176	22.5728	5.13315	.38693	21.8092	23.3365	9.00	30.00
	23-24	214	20.7299	5.98958	.40944	19.9228	21.5370	6.00	30.00
	25-30	398	21.0400	5.79628	.29054	20.4688	21.6112	6.00	30.00
	>30	471	22.5202	5.18431	.23888	22.0508	22.9896	6.00	30.00
	Total	1383	22.0352	5.53381	.14880	21.7433	22.3271	6.00	30.00
RE	<21	124	15.6962	3.41780	.30693	15.0887	16.3038	6.00	20.00
	21-22	176	14.2124	3.86141	.29106	13.6380	14.7869	4.00	20.00
	23-24	214	12.8408	4.37249	.29890	12.2516	13.4300	4.00	20.00
	25-30	398	12.6900	4.50547	.22584	12.2460	13.1340	4.00	20.00
	>30	471	12.5723	4.02561	.18549	12.2078	12.9368	4.00	20.00
	Total	1383	13.1365	4.25813	.11450	12.9119	13.3612	4.00	20.00
TG	<21	124	17.5764	2.24208	.20134	17.1778	17.9749	8.00	20.00
	21-22	176	17.2712	2.47679	.18669	16.9027	17.6397	10.00	20.00
	23-24	214	16.5793	2.75971	.18865	16.2075	16.9512	6.00	20.00
	25-30	398	16.8083	2.81916	.14131	16.5305	17.0861	4.00	20.00
	>30	471	17.1384	2.45556	.11315	16.9161	17.3607	4.00	20.00
	Total	1383	17.0131	2.61060	.07020	16.8754	17.1508	4.00	20.00

Note: MC - Management Commitment, RE - Resources, TG - Training

Table 22. Age: ANOVA and Homogeneity Results

		ANOVA					Homogeneity	
		Sum of Squares	df	Mean Square	F	Sig.	Levene Statistic	Sig.
MC	Between Groups	1921.949	4	480.487	16.389	.000	5.426	0.000
	Within Groups	40399.165	1378	29.317				
	Total	42321.115	1382					
RE	Between Groups	1264.184	4	316.046	18.304	.000	5.648	0.000
	Within Groups	23793.798	1378	17.267				
	Total	25057.982	1382					
TG	Between Groups	53.528	4	13.382	3.361	.010	4.377	0.002
	Within Groups	5486.829	1378	3.982				
	Total	5540.358	1382					

Note: MC - Management Commitment, RE - Resources, TG - Training

For the Management Commitment component, post hoc comparison (Dunnett T3) (Table 23) indicated that the composite score for respondents <21 (M = 24.88, SD = 4.21) was statistically significantly different than all other groups: 21-22 (M = 22.57, SD = 5.13), 23-24 (M = 20.73, SD = 5.99), 25-30 (M = 21.04, SD = 5.80), and >30 (M = 22.52, SD = 5.18). The 21-22 group (M = 22.57, SD = 5.13) composite mean was also statistically significantly different from groups 23-24 (M = 20.73, SD = 5.99) and 25-30 (M = 21.04, SD = 5.80), but no significant difference was found with group >30 (M = 22.52, SD = 5.18). No significant difference was found between group 23-24 (M = 20.73, SD = 5.99) and group 25-30 (M = 21.04, SD = 5.80), but a statistically significant difference in means existed with group >30 (M = 22.52, SD = 5.18). Lastly a statistically significant difference exists between the 25-30 condition (M = 21.04, SD = 5.80) and the >30 condition (M = 22.52, SD = 5.18).

Table 23. Age: Post-Hoc Analysis
(Management Commitment)

Dependent Variable		(I) Age	(J) Age	Mean Difference (I-J)	Std. Error	Sig.	Interval	
							Lower Bound	Upper Bound
MC	Dunnett T3	<21	21-22	2.30425	.54075	.000	.7793	3.8292
			23-24	4.14720	.55708	.000	2.5774	5.7170
			25-30	3.83709	.47657	.000	2.4928	5.1814
			>30	2.35687	.44695	.000	1.0941	3.6196
		21-22	<21	-2.30425	.54075	.000	-3.8292	-.7793
			23-24	1.84294	.56334	.012	.2572	3.4287
			25-30	1.53284	.48387	.016	.1706	2.8951
			>30	.05262	.45473	1.000	-1.2290	1.3342
		23-24	<21	-4.14720	.55708	.000	-5.7170	-2.5774
			21-22	-1.84294	.56334	.012	-3.4287	-.2572
			25-30	-.31010	.50205	1.000	-1.7227	1.1025
			>30	-1.79033	.47403	.002	-3.1252	-.4555
		25-30	<21	-3.83709	.47657	.000	-5.1814	-2.4928
			21-22	-1.53284	.48387	.016	-2.8951	-.1706
			23-24	.31010	.50205	1.000	-1.1025	1.7227
			>30	-1.48022	.37614	.001	-2.5360	-.4244
		>30	<21	-2.35687	.44695	.000	-3.6196	-1.0941
			21-22	-.05262	.45473	1.000	-1.3342	1.2290
			23-24	1.79033	.47403	.002	.4555	3.1252
			25-30	1.48022	.37614	.001	.4244	2.5360

For the Resources component, post hoc comparison (Dunnett T3) (Table *24*) indicated that the composite score for respondents <21 (M = 15.70, SD = 3.42) was statistically significantly different than all other groups: 21-22 (M = 14.21, SD = 3.86), 23-24 (M = 12.84, SD = 4.37), 25-30 (M = 12.69, SD = 4.51), and >30 (M = 12.57, SD = 4.03). The 21-22 group (M = 22.57, SD = 5.13) composite mean was also statistically significantly different from all other conditions, 23-24, 25-30, and >30. Group 23-24 had no significant difference in mean score when compared to 25-30, but there was a statistically significant difference between all other conditions. Aside from previously mentioned differences, the 25-30 and >30 groups had no further statistically significant differences.

Table 24. Age: Post-Hoc Analysis (Resources)

Dependent Variable		(I) Age	(J) Age	Mean Difference (I-J)	Std. Error	Sig.	Interval Lower Bound	Interval Upper Bound
RE	Dunnett T3	<21	21-22	1.48378	.42299	.005	.2907	2.6769
			23-24	2.85541	.42842	.000	1.6477	4.0631
			25-30	3.00621	.38106	.000	1.9309	4.0815
			>30	3.12390	.35862	.000	2.1103	4.1375
		21-22	<21	-1.48378	.42299	.005	-2.6769	-.2907
			23-24	1.37163	.41720	.011	.1972	2.5460
			25-30	1.52243	.36840	.000	.4854	2.5595
			>30	1.64012	.34515	.000	.6676	2.6127
		23-24	<21	-2.85541	.42842	.000	-4.0631	-1.6477
			21-22	-1.37163	.41720	.011	-2.5460	-.1972
			25-30	.15080	.37462	1.000	-.9030	1.2046
			>30	.26849	.35178	.997	-.7218	1.2588
		25-30	<21	-3.00621	.38106	.000	-4.0815	-1.9309
			21-22	-1.52243	.36840	.000	-2.5595	-.4854
			23-24	-.15080	.37462	1.000	-1.2046	.9030
			>30	.11769	.29225	1.000	-.7026	.9380
		>30	<21	-3.12390	.35862	.000	-4.1375	-2.1103
			21-22	-1.64012	.34515	.000	-2.6127	-.6676
			23-24	-.26849	.35178	.997	-1.2588	.7218
			25-30	-.11769	.29225	1.000	-.9380	.7026

For the Training component, post hoc comparison (Dunnett T3)(Table *25*) indicated that the composite score for respondents <21 (M = 13.16, SD = 1.71) was statistically significantly different than the 23-24 (M = 12.51, SD = 2.12) treatment. No significant difference was discovered in relation to groups 21-22 (M = 12.97, SD = 1.95), 25-30 (M = 12.69, SD = 2.19), or >30 (M = 12.95, SD = 1.85). Additionally, no significant mean differences were revealed amongst other groups.

Table 25. Age: Post-Hoc Analysis (Training)

Multiple Comparisons

Dependent Variable		(I) Age	(J) Age	Mean Difference (I-J)	Std. Error	Sig.	Interval Lower Bound	Interval Upper Bound
TG	Dunnett T3	<21	21-22	.18395	.21293	.992	-.4166	.7845
			23-24	.64714	.21144	.024	.0510	1.2433
			25-30	.46304	.18897	.139	-.0703	.9964
			>30	.20189	.17591	.943	-.2957	.6995
		21-22	<21	-.18395	.21293	.992	-.7845	.4166
			23-24	.46320	.20651	.226	-.1181	1.0445
			25-30	.27909	.18343	.746	-.2374	.7955
			>30	.01795	.16995	1.000	-.4612	.4971
		23-24	<21	-.64714	.21144	.024	-1.2433	-.0510
			21-22	-.46320	.20651	.226	-1.0445	.1181
			25-30	-.18411	.18170	.975	-.6952	.3270
			>30	-.44525	.16808	.081	-.9185	.0280
		25-30	<21	-.46304	.18897	.139	-.9964	.0703
			21-22	-.27909	.18343	.746	-.7955	.2374
			23-24	.18411	.18170	.975	-.3270	.6952
			>30	-.26114	.13876	.461	-.6507	.1284
		>30	<21	-.20189	.17591	.943	-.6995	.2957
			21-22	-.01795	.16995	1.000	-.4971	.4612
			23-24	.44525	.16808	.081	-.0280	.9185
			25-30	.26114	.13876	.461	-.1284	.6507

Note: MC - Management Commitment, RE - Resources, TG - Training

Time in Career Field

A one-way between subjects ANOVA was conducted to compare the effect of seven Time in Career Field conditions on perception of Management Commitment, perception of Training, and perception of Resources. The seven groups (see *Table 26*) were sorted as: less than one year (n = 113), 1 to 2 years (n = 254), 3 to 5 years (n = 357), 6 to 10 years (n = 242), 11 to 15 years (n = 209), 16 to 20 years (n = 133), and greater than 20 years (n = 75). There was a statistically significant difference regarding Time in Career Field's effect on all three components: Management Commitment ($F = 22.664$, $p < 0.001$), Resources ($F = 16.160$, $p < 0.001$), and Training ($F = 4.621$, $p < 0.001$). (*Table 27*)

Homogeneity of variance assumptions for Management Commitment (Levene's test: $p < .001$), Resources (Levene's test: $p < .021$), and Training (Levene's test: $p < .001$) were shaky so both Tukey HSD and Dunnett T3 post hoc tests were conducted with the Dunnett T3 used for comparisons.

Table 26. Time in Career Field: Composite Score Descriptive Statistics

		N	Mean	Std. Deviation	Std. Error	Interval for Mean Lower Bound	Upper Bound	Minimum	Maximum
MC	<1	113	25.4707	3.93378	.37006	24.7375	26.2039	16.00	30.00
	1-2	254	23.3481	5.07235	.31827	22.7213	23.9749	6.00	30.00
	3-5	357	20.4130	5.66473	.29981	19.8234	21.0026	6.00	30.00
	6-10	242	20.3697	5.65496	.36351	19.6536	21.0857	6.00	30.00
	11-15	209	21.9956	5.45343	.37722	21.2520	22.7393	6.00	30.00
	16-20	133	22.8724	5.00658	.43413	22.0137	23.7312	7.00	30.00
	20+	75	24.1342	4.71787	.54477	23.0487	25.2197	9.00	30.00
	Total	1383	22.0352	5.53381	.14880	21.7433	22.3271	6.00	30.00
RE	<1	113	15.8499	3.38744	.31866	15.2185	16.4813	5.00	20.00
	1-2	254	14.3317	4.12355	.25873	13.8221	14.8412	4.00	20.00
	3-5	357	12.8232	4.14014	.21912	12.3923	13.2541	4.00	20.00
	6-10	242	12.1553	4.41595	.28387	11.5961	12.7144	4.00	20.00
	11-15	209	12.3386	4.15026	.28708	11.7727	12.9046	4.00	20.00
	16-20	133	12.5110	4.02624	.34912	11.8204	13.2016	4.00	20.00
	20+	75	12.9915	4.18668	.48344	12.0282	13.9548	4.00	20.00
	Total	1383	13.1365	4.25813	.11450	12.9119	13.3612	4.00	20.00
TG	<1	113	13.2392	1.67276	.15736	12.9274	13.5510	5.00	15.00
	1-2	254	13.0597	1.85562	.11643	12.8304	13.2890	6.00	15.00
	3-5	357	12.4955	2.14698	.11363	12.2721	12.7190	4.00	15.00
	6-10	242	12.5926	2.22315	.14291	12.3111	12.8742	3.00	15.00
	11-15	209	12.9055	1.73136	.11976	12.6694	13.1416	7.00	15.00
	16-20	133	12.9634	1.96541	.17042	12.6263	13.3005	3.00	15.00
	20+	75	13.3460	1.94823	.22496	12.8978	13.7943	3.00	15.00
	Total	1383	12.8300	2.00223	.05384	12.7244	12.9356	3.00	15.00

Note: MC - Management Commitment, RE - Resources, TG - Training

Table 27. Time in Career Field: ANOVA and Homogeneity Results

		ANOVA Sum of Squares	df	Mean Square	F	Sig.	Homogeneity Levene Statistic	Sig.
MC	Between Groups	3806.289	6	634.381	22.664	.000	4.998	0.000
	Within Groups	38514.826	1376	27.990				
	Total	42321.115	1382					
RE	Between Groups	1649.494	6	274.916	16.160	.000	2.489	0.021
	Within Groups	23408.488	1376	17.012				
	Total	25057.982	1382					
TG	Between Groups	109.423	6	18.237	4.621	.000	3.786	0.001
	Within Groups	5430.935	1376	3.947				
	Total	5540.358	1382					

Note: MC - Management Commitment, RE - Resources, TG - Training

For the Management Commitment component, post hoc comparison (Dunnett T3)(see Table *28*) indicated that the composite score for respondents with less than one year Time in Unit (M = 25.47, SD = 3.93) was statistically significantly different than virtually all other groups: 1-2 years (M = 23.35, SD = 5.07), 3-5 years (M = 20.41, SD = 5.66), 6-10 years (M = 20.37, SD = 5.65), and 11-15 years (M = 22.00, SD = 5.45) and 16-20 years (M = 22.87, SD = 5.01) The only nonsignificant difference was when compared to the over 20 years group (M = 24.13, SD = 4.72). The 1-2 years group also shared a statistically significant difference in means with the 3-5 years and 6-10 years groups. However, the 3-5 years group and the 6-10 years group have no significant mean difference. 3-5 years does have a statistically significant difference in means with all other groups. With the exception of 3-5 years, 6-10 years shares a statistically significant difference in means with all other conditions. Including aforementioned differences, the 11-15 years group has a statistically significant difference in means with the over 20 years group.

Table 28. Years in Career Field: Post-Hoc Analysis (Management Commitment)

Dependent Variable		(I) Year in Career Field	(J) Year in Career Field	Mean Difference (I-J)	Std. Error	Sig.	Interval Lower Bound	Interval Upper Bound
MC	Dunnett T3	<1 year	1 - 2 years	2.12262	.48810	.000	.6301	3.6151
			3 - 5 years	5.05772	.47627	.000	3.6013	6.5141
			6 - 10 years	5.10105	.51874	.000	3.5162	6.6859
			11 - 15 years	3.47508	.52843	.000	1.8603	5.0899
			16 - 20 years	2.59828	.57045	.000	.8520	4.3445
			20+ years	1.33653	.65857	.600	-.6947	3.3677
		1 - 2 years	<1 year	-2.12262	.48810	.000	-3.6151	-.6301
			3 - 5 years	2.93510	.43724	.000	1.6044	4.2658
			6 - 10 years	2.97842	.48315	.000	1.5067	4.4501
			11 - 15 years	1.35246	.49355	.125	-.1518	2.8567
			16 - 20 years	.47566	.53829	1.000	-1.1704	2.1217
			20+ years	-.78609	.63093	.992	-2.7346	1.1624
		3 - 5 years	<1 year	-5.05772	.47627	.000	-6.5141	-3.6013
			1 - 2 years	-2.93510	.43724	.000	-4.2658	-1.6044
			6 - 10 years	.04332	.47120	1.000	-1.3915	1.4781
			11 - 15 years	-1.58265	.48185	.023	-3.0509	-.1144
			16 - 20 years	-2.45945	.52759	.000	-4.0731	-.8458
			20+ years	-3.72119	.62182	.000	-5.6432	-1.7992
		6 - 10 years	<1 year	-5.10105	.51874	.000	-6.6859	-3.5162
			1 - 2 years	-2.97842	.48315	.000	-4.4501	-1.5067
			3 - 5 years	-.04332	.47120	1.000	-1.4781	1.3915
			11 - 15 years	-1.62597	.52387	.042	-3.2224	-.0296
			16 - 20 years	-2.50277	.56622	.000	-4.2327	-.7728
			20+ years	-3.76452	.65492	.000	-5.7827	-1.7463
		11 - 15 years	<1 year	-3.47508	.52843	.000	-5.0899	-1.8603
			1 - 2 years	-1.35246	.49355	.125	-2.8567	.1518
			3 - 5 years	1.58265	.48185	.023	.1144	3.0509
			6 - 10 years	1.62597	.52387	.042	.0296	3.2224
			16 - 20 years	-.87680	.57512	.940	-2.6340	.8804
			20+ years	-2.13855	.66263	.032	-4.1796	-.0975
		16 - 20 years	<1 year	-2.59828	.57045	.000	-4.3445	-.8520
			1 - 2 years	-.47566	.53829	1.000	-2.1217	1.1704
			3 - 5 years	2.45945	.52759	.000	.8458	4.0731
			6 - 10 years	2.50277	.56622	.000	.7728	4.2327
			11 - 15 years	.87680	.57512	.940	-.8804	2.6340
			20+ years	-1.26175	.69659	.779	-3.4049	.8814
		20+ years	<1 year	-1.33653	.65857	.600	-3.3677	.6947
			1 - 2 years	.78609	.63093	.992	-1.1624	2.7346
			3 - 5 years	3.72119	.62182	.000	1.7992	5.6432
			6 - 10 years	3.76452	.65492	.000	1.7463	5.7827
			11 - 15 years	2.13855	.66263	.032	.0975	4.1796
			16 - 20 years	1.26175	.69659	.779	-.8814	3.4049

For the Resources component, post hoc comparison (Dunnett T3)(see Table *29*) indicated that the composite score for respondents with less than one year Time in Unit (M = 15.85, SD = 3.39) was statistically significantly different than all other groups: 1-2 years (M = 14.33, SD = 4.12), 3-5 years (M = 12.82, SD = 4.14), 6-10 years (M = 12.16, SD = 4.42), and 11-15 years (M = 12.34, SD = 4.15) and 16-20 years (M = 12.51, SD = 4.03), and over 20 years (M = 12.99, SD = 4.19) The only nonsignificant difference was when compared to the over 20 years group (M = 24.13, SD = 4.72). The 1-2 years group also shared a statistically significant difference in means with the 3-5 years and 6-10 years groups. However, the 3-5 years group and the 6-10 years group have no significant mean difference. 3-5 years does have a statistically significant difference in means with all other groups. With the exception of 3-5 years, 6-10 years shares a statistically significant difference in means with all other conditions. Including aforementioned differences, the 11-15 years group has a statistically significant difference in means with the over 20 years group.

Table 29. Years in Career Field: Post-Hoc Analysis (Resources)

Dependent Variable		(I) Year in Career Field	(J) Year in Career Field	Mean Difference (I-J)	Std. Error	Sig.	Interval	
							Lower Bound	Upper Bound
RE	Dunnett T3	<1 year	1 - 2 years	1.51821	.41048	.006	.2625	2.7740
			3 - 5 years	3.02670	.38673	.000	1.8420	4.2114
			6 - 10	3.69462	.42676	.000	2.3899	4.9993
			11 - 15	3.51127	.42891	.000	2.1997	4.8228
			16 - 20	3.33888	.47268	.000	1.8920	4.7858
			20+ years	2.85839	.57901	.000	1.0718	4.6449
		1 - 2 years	<1 year	-1.51821	.41048	.006	-2.7740	-.2625
			3 - 5 years	1.50849	.33905	.000	.4763	2.5406
			6 - 10	2.17640	.38409	.000	1.0065	3.3463
			11 - 15	1.99305	.38647	.000	.8153	3.1708
			16 - 20	1.82067	.43454	.001	.4920	3.1494
			20+ years	1.34018	.54832	.280	-.3557	3.0360
		3 - 5 years	<1 year	-3.02670	.38673	.000	-4.2114	-1.8420
			1 - 2 years	-1.50849	.33905	.000	-2.5406	-.4763
			6 - 10	.66792	.35860	.741	-.4242	1.7601
			11 - 15	.48457	.36115	.984	-.6161	1.5852
			16 - 20	.31218	.41219	1.000	-.9496	1.5740
			20+ years	-.16831	.53078	1.000	-1.8140	1.4773
		6 - 10 years	<1 year	-3.69462	.42676	.000	-4.9993	-2.3899
			1 - 2 years	-2.17640	.38409	.000	-3.3463	-1.0065
			3 - 5 years	-.66792	.35860	.741	-1.7601	.4242
			11 - 15	-.18335	.40373	1.000	-1.4136	1.0469
			16 - 20	-.35573	.44996	1.000	-1.7307	1.0193
			20+ years	-.83622	.56062	.948	-2.5675	.8951
		11 - 15 years	<1 year	-3.51127	.42891	.000	-4.8228	-2.1997
			1 - 2 years	-1.99305	.38647	.000	-3.1708	-.8153
			3 - 5 years	-.48457	.36115	.984	-1.5852	.6161
			6 - 10	.18335	.40373	1.000	-1.0469	1.4136
			16 - 20	-.17238	.45199	1.000	-1.5539	1.2091
			20+ years	-.65287	.56225	.997	-2.3891	1.0833
		16 - 20 years	<1 year	-3.33888	.47268	.000	-4.7858	-1.8920
			1 - 2 years	-1.82067	.43454	.001	-3.1494	-.4920
			3 - 5 years	-.31218	.41219	1.000	-1.5740	.9496
			6 - 10	.35573	.44996	1.000	-1.0193	1.7307
			11 - 15	.17238	.45199	1.000	-1.2091	1.5539
			20+ years	-.48049	.59632	1.000	-2.3175	1.3565
		20+ years	<1 year	-2.85839	.57901	.000	-4.6449	-1.0718
			1 - 2 years	-1.34018	.54832	.280	-3.0360	.3557
			3 - 5 years	.16831	.53078	1.000	-1.4773	1.8140
			6 - 10	.83622	.56062	.948	-.8951	2.5675
			11 - 15	.65287	.56225	.997	-1.0833	2.3891
			16 - 20	.48049	.59632	1.000	-1.3565	2.3175

For the Training component, post hoc comparison (Dunnett T3) (see *Table 30*) indicated that the composite score for respondents with less than 3-5 years' Time in Unit condition (M = 12.50, SD = 2.15) had a statistically significant difference in means when compared to the less than 1 year group (M = 13.24, SD = 1.67), the 1-2 years group (M = 13.06, SD = 1.86), and the 20+ group (M = 13.35, SD = 1.95). No other significant mean differences were discovered amongst other groups.

Table 30. Years in Career Field: Post-Hoc Analysis (Training)

Multiple Comparisons

Dependent Variable		(I) Year in Career Field	(J) Year in Career Field	Mean Difference (I-J)	Std. Error	Sig.	Interval Lower Bound	Interval Upper Bound
TG	Dunnett T3	<1	1-2	.17946	.19575	1.000	-.4199	.7788
			3-5	.74364	.19410	.003	.1494	1.3379
			6-10	.64654	.21257	.052	-.0032	1.2963
			11-15	.33368	.19775	.863	-.2718	.9392
			16-20	.27575	.23196	.996	-.4343	.9858
			20+	-.10685	.27454	1.000	-.9533	.7395
		1-2	<1	-.17946	.19575	1.000	-.7788	.4199
			3-5	.56418	.16269	.012	.0691	1.0593
			6-10	.46708	.18434	.216	-.0945	1.0286
			11-15	.15422	.16703	1.000	-.3547	.6632
			16-20	.09630	.20640	1.000	-.5352	.7278
			20+	-.28631	.25331	.998	-1.0702	.4975
		3-5	<1	-.74364	.19410	.003	-1.3379	-.1494
			1-2	-.56418	.16269	.012	-1.0593	-.0691
			6-10	-.09710	.18258	1.000	-.6531	.4589
			11-15	-.40996	.16509	.244	-.9127	.0928
			16-20	-.46788	.20483	.384	-1.0946	.1588
			20+	-.85049	.25203	.021	-1.6306	-.0704
		6-10	<1	-.64654	.21257	.052	-1.2963	.0032
			1-2	-.46708	.18434	.216	-1.0286	.0945
			3-5	.09710	.18258	1.000	-.4589	.6531
			11-15	-.31286	.18646	.870	-.8810	.2553
			16-20	-.37078	.22241	.876	-1.0503	.3087
			20+	-.75339	.26652	.106	-1.5754	.0686
		11-15	<1	-.33368	.19775	.863	-.9392	.2718
			1-2	-.15422	.16703	1.000	-.6632	.3547
			3-5	.40996	.16509	.244	-.0928	.9127
			6-10	.31286	.18646	.870	-.2553	.8810
			16-20	-.05792	.20829	1.000	-.6952	.5794
			20+	-.44053	.25485	.835	-1.2289	.3478
		16-20	<1	-.27575	.23196	.996	-.9858	.4343
			1-2	-.09630	.20640	1.000	-.7278	.5352
			3-5	.46788	.20483	.384	-.1588	1.0946
			6-10	.37078	.22241	.876	-.3087	1.0503
			11-15	.05792	.20829	1.000	-.5794	.6952
			20+	-.38261	.28223	.980	-1.2515	.4863
		20+	<1	.10685	.27454	1.000	-.7395	.9533
			1-2	.28631	.25331	.998	-.4975	1.0702
			3-5	.85049	.25203	.021	.0704	1.6306
			6-10	.75339	.26652	.106	-.0686	1.5754
			11-15	.44053	.25485	.835	-.3478	1.2289
			16-20	.38261	.28223	.980	-.4863	1.2515

Note: MC - Management Commitment, RE - Resources, TG - Training

Time in Unit

A one-way between subjects ANOVA was conducted to compare the effect of nine Time in Unit conditions on perception of Management Commitment, perception of Training, and perception of Resources. The nine groups were (see *Table 31*): less than one month ($n = 25$), 1-3 months ($n = 101$), 4-6 months ($n = 102$), 7-12 months ($n = 156$), 13-24 months ($n = 287$), 2-5 years ($n = 533$), 6-10 years ($n = 112$), 11-20 years ($n = 61$), and more than 20 years ($n = 6$). Sample size for the over 20 years' time in unit group was small, but deemed relevant to explore the relationships between new arrivals and the most seasoned members. There was a statistically significant difference regarding Time in Career Field's effect on all two components, Management Commitment ($F= 12.837$, $p < 0.001$) and Resources ($F= 8.962$, $p < 0.001$), but no between group differences regarding Training ($F= 1.328$, $p < .225$). (see *Table 32*)

Homogeneity of variance assumptions for Management Commitment (Levene's test: $p < .064$), Resources (Levene's test: $p < .087$) were strong, but Training (Levene's test: $p < .008$) was shaky (see *Table 31*). Since no inter-group differences were discovered for Training, only Tukey's HSD was utilized for comparisons.

Table 31. Time in Unit: Composite Score Descriptive Statistics

		N	Mean	Std. Deviation	Std. Error	Interval for Mean Lower Bound	Interval for Mean Upper Bound	Minimum	Maximum
MC	<1 month	25	25.0286	3.40994	.68199	23.6210	26.4362	18.00	30.00
	1-3 months	101	24.1234	5.16422	.51386	23.1039	25.1429	6.00	30.00
	4-6 months	102	23.5311	4.76261	.47157	22.5956	24.4665	9.00	30.00
	7-12 months	156	23.5416	5.32475	.42632	22.6995	24.3838	6.00	30.00
	13-24 months	287	22.8251	5.36257	.31654	22.2020	23.4481	6.00	30.00
	2-5 years	533	20.6623	5.56366	.24099	20.1889	21.1357	6.00	30.00
	6-10 years	112	20.0267	5.30240	.50103	19.0338	21.0195	6.00	30.00
	11-20 years	61	22.7442	5.35354	.68545	21.3731	24.1153	10.00	30.00
	>20 years	6	24.2813	6.53641	2.66848	17.4217	31.1408	12.00	30.00
	Total	1383	22.0352	5.53381	.14880	21.7433	22.3271	6.00	30.00
RE	<1 month	25	15.2376	3.17432	.63486	13.9273	16.5479	7.00	20.00
	1-3 months	101	14.7863	3.82498	.38060	14.0312	15.5414	4.00	20.00
	4-6 months	102	13.4961	4.39583	.43525	12.6327	14.3595	4.00	20.00
	7-12 months	156	14.2581	4.15187	.33242	13.6015	14.9148	4.00	20.00
	13-24 months	287	13.7130	4.23832	.25018	13.2206	14.2055	4.00	20.00
	2-5 years	533	12.4327	4.24255	.18377	12.0717	12.7937	4.00	20.00
	6-10 years	112	11.6881	3.99863	.37784	10.9394	12.4368	4.00	20.00
	11-20 years	61	12.3105	3.98454	.51017	11.2900	13.3310	4.00	20.00
	>20 years	6	11.7234	3.04427	1.24282	8.5286	14.9182	6.00	14.00
	Total	1383	13.1365	4.25813	.11450	12.9119	13.3612	4.00	20.00
TG	<1 month	25	12.9437	1.69443	.33889	12.2443	13.6431	8.00	15.00
	1-3 months	101	12.9799	1.85738	.18482	12.6132	13.3465	6.00	15.00
	4-6 months	102	12.8871	2.03043	.20104	12.4882	13.2859	5.00	15.00
	7-12 months	156	13.0623	1.95525	.15655	12.7530	13.3715	4.00	15.00
	13-24 months	287	12.9627	2.04100	.12048	12.7256	13.1999	3.00	15.00
	2-5 years	533	12.6656	1.96068	.08493	12.4988	12.8324	4.00	15.00
	6-10 years	112	12.5885	2.23656	.21133	12.1697	13.0072	3.00	15.00
	11-20 years	61	13.1170	1.67271	.21417	12.6886	13.5454	8.00	15.00
	>20 years	6	12.6667	4.80278	1.96073	7.6265	17.7069	3.00	15.00
	Total	1383	12.8300	2.00223	.05384	12.7244	12.9356	3.00	15.00

Note: MC - Management Commitment, RE - Resources, TG - Training

Table 32. Time in Unit: ANOVA and Homogeneity Results

		ANOVA Sum of Squares	df	Mean Square	F	Sig.	Homogeneity Levene Statistic	Sig.
MC	Between Groups	2943.191	8	367.899	12.837	.000	1.853	0.064
	Within Groups	39377.924	1374	28.659				
	Total	42321.115	1382					
RE	Between Groups	1242.719	8	155.340	8.962	.000	1.729	0.087
	Within Groups	23815.263	1374	17.333				
	Total	25057.982	1382					
TG	Between Groups	42.522	8	5.315	1.328	.225	2.592	0.008
	Within Groups	5497.836	1374	4.001				
	Total	5540.358	1382					

Note: MC - Management Commitment, RE - Resources, TG - Training

For the Management Commitment component, post hoc comparison (Tukey HSD) (see Table 33) indicated that the composite score for conditions 2-5 years (M = 20.66, SD = 5.56) and 6-10 years (M = 20.03, SD = 5.30) were not significantly different, but a statistically significant difference in means exists between both of those conditions and the conditions of less than one month (M = 25.03, SD = 3.41), 1-3 months (M = 24.12, SD = 5.16), 4-6 months (M = 23.53, SD = 4.76), 7-12 months (M = 23.54, SD = 5.32), and 13-24 months (M = 22.83, SD = 5.36). Additionally, the mean difference is statistically significant between 6-10 years and 11-20 years (M = 22.74, SD = 5.35). Post hoc tests revealed no significant differences among other groups.

Table 33. Time in Unit: Post-Hoc Analysis (Management Commitment)

Dependent Variable		(I) Time in Unit	(J) Time in Unit	Mean Difference (I-J)	Std. Error	Sig.	Interval	
							Lower Bound	Upper Bound
MC	Tukey HSD	<1 month	1 to 3 months	.90520	1.19588	.998	-2.8101	4.6205
			4 to 6 months	1.49754	1.19472	.944	-2.2141	5.2092
			7 - 12 months	1.48697	1.15329	.935	-2.0960	5.0699
			13 - 24 months	2.20351	1.11635	.562	-1.2647	5.6717
			2 - 5 years	4.36633	1.09551	.002	.9629	7.7698
			6 - 10 years	5.00194	1.18417	.001	1.3231	8.6808
			11 - 20 years	2.28442	1.27130	.684	-1.6651	6.2340
			>20 years	.74735	2.43371	1.000	-6.8135	8.3082
		1 to 3 months	<1 month	-.90520	1.19588	.998	-4.6205	2.8101
			4 to 6 months	.59233	.75148	.997	-1.7423	2.9270
			7 - 12 months	.58176	.68372	.995	-1.5423	2.7059
			13 - 24 months	1.29831	.61937	.476	-.6259	3.2225
			2 - 5 years	3.46113	.58097	.000	1.6562	5.2660
			6 - 10 years	4.09674	.73460	.000	1.8145	6.3789
			11 - 20 years	1.37922	.86809	.811	-1.3177	4.0761
			>20 years	-.15786	2.24951	1.000	-7.1464	6.8307
		4 to 6 months	<1 month	-1.49754	1.19472	.944	-5.2092	2.2141
			1 to 3 months	-.59233	.75148	.997	-2.9270	1.7423
			7 - 12 months	-.01057	.68168	1.000	-2.1284	2.1072
			13 - 24 months	.70598	.61712	.967	-1.2112	2.6232
			2 - 5 years	2.86880	.57857	.000	1.0713	4.6663
			6 - 10 years	3.50440	.73271	.000	1.2281	5.7807
			11 - 20 years	.78689	.86649	.993	-1.9050	3.4788
			>20 years	-.75019	2.24890	1.000	-7.7369	6.2365
		7 - 12 months	<1 month	-1.48697	1.15329	.935	-5.0699	2.0960
			1 to 3 months	-.58176	.68372	.995	-2.7059	1.5423
			4 to 6 months	.01057	.68168	1.000	-2.1072	2.1284
			13 - 24 months	.71655	.53251	.917	-.9378	2.3709
			2 - 5 years	2.87937	.48732	.000	1.3654	4.3933
			6 - 10 years	3.51497	.66302	.000	1.4552	5.5748
			11 - 20 years	.79745	.80842	.987	-1.7141	3.3090
			>20 years	-.73962	2.22717	1.000	-7.6588	6.1795
		13 - 24 months	<1 month	-2.20351	1.11635	.562	-5.6717	1.2647
			1 to 3 months	-1.29831	.61937	.476	-3.2225	.6259
			4 to 6 months	-.70598	.61712	.967	-2.6232	1.2112
			7 - 12 months	-.71655	.53251	.917	-2.3709	.9378
			2 - 5 years	2.16282	.39195	.000	.9451	3.3805
			6 - 10 years	2.79843	.59644	.000	.9454	4.6514
			11 - 20 years	.08091	.75477	1.000	-2.2640	2.4258
			>20 years	-1.45617	2.20826	.999	-8.3166	5.4043
		2 - 5 years	<1 month	-4.36633	1.09551	.002	-7.7698	-.9629
			1 to 3 months	-3.46113	.58097	.000	-5.2660	-1.6562
			4 to 6 months	-2.86880	.57857	.000	-4.6663	-1.0713
			7 - 12 months	-2.87937	.48732	.000	-4.3933	-1.3654
			13 - 24 months	-2.16282	.39195	.000	-3.3805	-.9451
			6 - 10 years	.63560	.55647	.968	-1.0932	2.3644
			11 - 20 years	-2.08191	.72360	.095	-4.3299	.1661
			>20 years	-3.61899	2.19780	.779	-10.4469	3.2089
		6 - 10 years	<1 month	-5.00194	1.18417	.001	-8.6808	-1.3231
			1 to 3 months	-4.09674	.73460	.000	-6.3789	-1.8145
			4 to 6 months	-3.50440	.73271	.000	-5.7807	-1.2281
			7 - 12 months	-3.51497	.66302	.000	-5.5748	-1.4552
			13 - 24 months	-2.79843	.59644	.000	-4.6514	-.9454
			2 - 5 years	-.63560	.55647	.968	-2.3644	1.0932
			11 - 20 years	-2.71752	.85189	.039	-5.3641	-.0710
			>20 years	-4.25459	2.24331	.616	-11.2239	2.7147
		11 - 20 years	<1 month	-2.28442	1.27130	.684	-6.2340	1.6651
			1 to 3 months	-1.37922	.86809	.811	-4.0761	1.3177
			4 to 6 months	-.78689	.86649	.993	-3.4788	1.9050
			7 - 12 months	-.79745	.80842	.987	-3.3090	1.7141
			13 - 24 months	-.08091	.75477	1.000	-2.4258	2.2640
			2 - 5 years	2.08191	.72360	.095	-.1661	4.3299
			6 - 10 years	2.71752	.85189	.039	.0710	5.3641
			>20 years	-1.53707	2.29050	.999	-8.6530	5.5788
		>20 years	<1 month	-.74735	2.43371	1.000	-8.3082	6.8135
			1 to 3 months	.15786	2.24951	1.000	-6.8307	7.1464
			4 to 6 months	.75019	2.24890	1.000	-6.2365	7.7369
			7 - 12 months	.73962	2.22717	1.000	-6.1795	7.6588
			13 - 24 months	1.45617	2.20826	.999	-5.4043	8.3166
			2 - 5 years	3.61899	2.19780	.779	-3.2089	10.4469
			6 - 10 years	4.25459	2.24331	.616	-2.7147	11.2239
			11 - 20 years	1.53707	2.29050	.999	-5.5788	8.6530

For the Resources component, post hoc comparison (Tukey HSD) (see *Table 34*) indicated that the composite score for respondents differed with statistical significance between 6-10 years (M = 11.69, SD = 4.00) and less than one month (M = 15.24, SD = 3.17), 1-3 months (M = 14.79, SD = 3.82), 4-6 months (M = 13.50, SD = 4.40), 7-12 months (M = 14.26, SD = 4.15), and 13-24 months (M = 13.71, SD = 4.24). 2-5 years (M = 12.43, SD = 4.24) mean composite score difference was statistically significant for the same groups with the exception of 4-6 months. The 1-3 month group was also statistically different from the 11-20 years group (M = 12.31, SD = 3.98). The only group with so significant intergroup differences was the greater than 20 years group (M = 11.72, SD = 3.04)

Table 34. Time in Unit: Post-Hoc Analysis (Resources)

Multiple Comparisons

Dependent Variable		(I) Time in Unit	(J) Time in Unit	Mean Difference (I-J)	Std. Error	Sig.	Interval Lower Bound	Interval Upper Bound
RE	Tukey HSD	<1 month	1-3	.45135	.93001	1.000	-2.4379	3.3406
			4-6	1.74152	.92911	.632	-1.1449	4.6280
			7-12	.97952	.89689	.975	-1.8069	3.7659
			13-24	1.52460	.86816	.711	-1.1725	4.2217
			2-5 years	2.80497	.85196	.028	.1582	5.4518
			6-10 years	3.54957	.92091	.004	.6886	6.4106
			11-20	2.92712	.98866	.076	-.1444	5.9986
			>20 years	3.51423	1.89265	.644	-2.3657	9.3941
		1-3 months	<1 month	-.45135	.93001	1.000	-3.3406	2.4379
			4-6	1.29017	.58442	.401	-.5254	3.1058
			7-12	.52817	.53171	.987	-1.1237	2.1800
			13-24	1.07325	.48167	.388	-.4232	2.5697
			2-5 years	2.35362	.45181	.000	.9500	3.7573
			6-10 years	3.09822	.57129	.000	1.3234	4.8730
			11-20	2.47577	.67510	.008	.3784	4.5731
			>20 years	3.06288	1.74940	.715	-2.3720	8.4978
		4-6 months	<1 month	-1.74152	.92911	.632	-4.6280	1.1449
			1-3	-1.29017	.58442	.401	-3.1058	.5254
			7-12	-.76200	.53013	.883	-2.4090	.8850
			13-24	-.21692	.47992	1.000	-1.7079	1.2740
			2-5 years	1.06345	.44994	.305	-.3344	2.4613
			6-10 years	1.80805	.56981	.041	.0378	3.5783
			11-20	1.18560	.67385	.709	-.9079	3.2791
			>20 years	1.77271	1.74892	.985	-3.6607	7.2061
		7-12 months	<1 month	-.97952	.89689	.975	-3.7659	1.8069
			1-3	-.52817	.53171	.987	-2.1800	1.1237
			4-6	.76200	.53013	.883	-.8850	2.4090
			13-24	.54508	.41413	.927	-.7415	1.8317
			2-5 years	1.82545	.37898	.000	.6481	3.0028
			6-10 years	2.57005	.51562	.000	.9682	4.1719
			11-20	1.94760	.62869	.051	-.0056	3.9008
			>20 years	2.53471	1.73202	.872	-2.8462	7.9156
		13-24 months	<1 month	-1.52460	.86816	.711	-4.2217	1.1725
			1-3	-1.07325	.48167	.388	-2.5697	.4232
			4-6	.21692	.47992	1.000	-1.2740	1.7079
			7-12	-.54508	.41413	.927	-1.8317	.7415
			2-5 years	1.28037	.30482	.001	.3334	2.2273
			6-10 years	2.02497	.46384	.000	.5839	3.4660
			11-20	1.40252	.58697	.290	-.4210	3.2261
			>20 years	1.98963	1.71732	.965	-3.3456	7.3249
		2-5 years	<1 month	-2.80497	.85196	.028	-5.4518	-.1582
			1-3	-2.35362	.45181	.000	-3.7573	-.9500
			4-6	-1.06345	.44994	.305	-2.4613	.3344
			7-12	-1.82545	.37898	.000	-3.0028	-.6481
			13-24	-1.28037	.30482	.001	-2.2273	-.3334
			6-10 years	.74460	.43275	.734	-.5998	2.0890
			11-20	.12215	.56273	1.000	-1.6261	1.8704
			>20 years	.70926	1.70919	1.000	-4.6007	6.0192
		6-10 years	<1 month	-3.54957	.92091	.004	-6.4106	-.6886
			1-3	-3.09822	.57129	.000	-4.8730	-1.3234
			4-6	-1.80805	.56981	.041	-3.5783	-.0378
			7-12	-2.57005	.51562	.000	-4.1719	-.9682
			13-24	-2.02497	.46384	.000	-3.4660	-.5839
			2-5 years	-.74460	.43275	.734	-2.0890	.5998
			11-20	-.62245	.66250	.991	-2.6806	1.4357
			>20 years	-.03534	1.74458	1.000	-5.4552	5.3846
		11-20 years	<1 month	-2.92712	.98866	.076	-5.9986	.1444
			1-3	-2.47577	.67510	.008	-4.5731	-.3784
			4-6	-1.18560	.67385	.709	-3.2791	.9079
			7-12	-1.94760	.62869	.051	-3.9008	.0056
			13-24	-1.40252	.58697	.290	-3.2261	.4210
			2-5 years	-.12215	.56273	1.000	-1.8704	1.6261
			6-10 years	.62245	.66250	.991	-1.4357	2.6806
			>20 years	.58711	1.78128	1.000	-4.9468	6.1210
		>20 years	<1 month	-3.51423	1.89265	.644	-9.3941	2.3657
			1-3	-3.06288	1.74940	.715	-8.4978	2.3720
			4-6	-1.77271	1.74892	.985	-7.2061	3.6607
			7-12	-2.53471	1.73202	.872	-7.9156	2.8462
			13-24	-1.98963	1.71732	.965	-7.3249	3.3456
			2-5 years	-.70926	1.70919	1.000	-6.0192	4.6007
			6-10 years	.03534	1.74458	1.000	-5.3846	5.4552
			11-20	-.58711	1.78128	1.000	-6.1210	4.9468

Note: MC - Management Commitment, RE - Resources, TG - Training

Date Completed

In an attempt to identify a trend in safety climate in relation to time, respondents were grouped by date that the survey was taken. This analysis was conducted in two forms. The first analysis was performed by forming four groups related to the year in which the survey was taken (see *Table 35*): 2013 (n = 320), 2014 (n = 339), 2015 (n = 393), and 2016 (n = 327). This analysis showed no significant difference between groups regarding Management Commitment ($F = .552$, $p < .647$), Resources ($F = .159$, $p < .846$), or Training ($F = .108$, $p < .956$) (see *Table 36*)

Table 35. Year Completed: Composite Score Descriptive Statistics

						Interval for Mean			
		N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Minimum	Maximum
Training	2013	320	12.8560	1.97751	.11055	12.6385	13.0735	4.00	15.00
	2014	339	12.8619	2.09402	.11373	12.6382	13.0856	3.00	15.00
	2015	393	12.7933	1.92790	.09725	12.6021	12.9845	3.00	15.00
	2016	327	12.8042	2.03223	.11238	12.5831	13.0253	3.00	15.00
	Total	1379	12.8273	2.00403	.05397	12.7214	12.9332	3.00	15.00
Resources	2013	320	13.4770	4.39918	.24592	12.9931	13.9608	4.00	20.00
	2014	339	12.7291	4.27298	.23208	12.2726	13.1856	4.00	20.00
	2015	393	13.1782	4.14796	.20924	12.7668	13.5895	4.00	20.00
	2016	327	13.1519	4.22932	.23388	12.6918	13.6120	4.00	20.00
	Total	1379	13.1309	4.26062	.11473	12.9058	13.3560	4.00	20.00
Management	2013	320	21.7795	6.09599	.34078	21.1090	22.4499	6.00	30.00
	2014	339	22.3068	5.54510	.30117	21.7144	22.8992	6.00	30.00
	2015	393	21.9340	5.18111	.26135	21.4202	22.4478	6.00	30.00
	2016	327	22.0893	5.38088	.29756	21.5039	22.6747	7.00	30.00
	Total	1379	22.0266	5.53783	.14913	21.7341	22.3192	6.00	30.00

Table 36. Year Completed: ANOVA and Homogeneity Results

		ANOVA					Homogeneity	
		Sum of Squares	df	Mean Square	F	Sig.	Levene Statistic	Sig.
Training	Between Groups	1.298	3	.433	.108	.956	1.213	0.304
	Within Groups	5532.914	1375	4.024				
	Total	5534.212	1378					
Resources	Between Groups	94.072	3	31.357	1.730	.159	0.272	0.846
	Within Groups	24920.634	1375	18.124				
	Total	25014.706	1378					
Management	Between Groups	50.823	3	16.941	.552	.647	3.772	0.010
	Within Groups	42209.030	1375	30.697				
	Total	42259.853	1378					

A second attempt was made to discover differences by further dividing the data by quarters. Nine distinct groups were identified (see *Table 37*): 3rd Quarter 2013 (n= 281), 4th Quarter 2013 (n = 39), 1st Quarter 2014 (n = 8), 3rd Quarter 2014 (n = 233), 4th Quarter 2014 (n = 98), 3rd Quarter 2015 (n = 393), 2nd Quarter 2016 (n = 10), 3rd Quarter 2016 (n = 73), and 4th Quarter 2016 (n = 244). This analysis showed no significant difference between groups regarding Management Commitment ($F = 1.167$, $p < .315$), Resources ($F = 1.633$, $p < .111$), or Training ($F = .523$, $p < .840$)) (see *Table 38*)

Table 37. Quarter Completed: Composite Score Descriptive Statistics

		N	Mean	Std. Deviation	Std. Error	Interval for Mean Lower Bound	Upper Bound	Minimum	Maximum
Training	3Q 2013	281	12.9190	1.96323	.11712	12.6885	13.1496	4.00	15.00
	4Q 2013	39	12.4021	2.04631	.32767	11.7387	13.0654	8.00	15.00
	1Q 2014	8	12.1250	3.44083	1.21652	9.2484	15.0016	6.00	15.00
	3Q 2014	233	12.9124	1.97364	.12930	12.6577	13.1672	3.00	15.00
	4Q 2014	98	12.8020	2.24811	.22709	12.3512	13.2527	6.00	15.00
	3Q 2015	393	12.7933	1.92790	.09725	12.6021	12.9845	3.00	15.00
	2Q 2016	10	13.1227	2.07177	.65515	11.6407	14.6048	8.23	15.00
	3Q 2016	73	12.8176	2.15936	.25273	12.3137	13.3214	6.00	15.00
	4Q 2016	244	12.7871	1.99888	.12797	12.5351	13.0392	3.00	15.00
	Total	1379	12.8273	2.00403	.05397	12.7214	12.9332	3.00	15.00
Resources	3Q 2013	281	13.5981	4.42329	.26387	13.0787	14.1175	4.00	20.00
	4Q 2013	39	12.6039	4.17184	.66803	11.2516	13.9563	4.00	20.00
	1Q 2014	8	15.0000	4.27618	1.51186	11.4250	18.5750	9.00	20.00
	3Q 2014	233	12.8091	4.28372	.28064	12.2562	13.3620	4.00	20.00
	4Q 2014	98	12.3535	4.22252	.42654	11.5069	13.2001	4.00	20.00
	3Q 2015	393	13.1782	4.14796	.20924	12.7668	13.5895	4.00	20.00
	2Q 2016	10	10.9340	5.69318	1.80034	6.8614	15.0067	4.00	20.00
	3Q 2016	73	13.1148	4.04258	.47315	12.1716	14.0580	4.00	20.00
	4Q 2016	244	13.2539	4.21198	.26964	12.7228	13.7851	4.00	20.00
	Total	1379	13.1309	4.26062	.11473	12.9058	13.3560	4.00	20.00
Management	3Q 2013	281	22.0727	6.06203	.36163	21.3608	22.7845	6.00	30.00
	4Q 2013	39	19.6667	5.99708	.96030	17.7226	21.6107	6.00	30.00
	1Q 2014	8	23.7500	5.77556	2.04197	18.9215	28.5785	14.00	30.00
	3Q 2014	233	22.2818	5.52211	.36177	21.5691	22.9946	6.00	30.00
	4Q 2014	98	22.2484	5.62367	.56808	21.1210	23.3759	6.00	30.00
	3Q 2015	393	21.9340	5.18111	.26135	21.4202	22.4478	6.00	30.00
	2Q 2016	10	23.1375	6.94628	2.19661	18.1684	28.1066	9.00	30.00
	3Q 2016	73	22.3564	4.86788	.56974	21.2207	23.4922	8.00	30.00
	4Q 2016	244	21.9664	5.47298	.35037	21.2763	22.6566	7.00	30.00
	Total	1379	22.0266	5.53783	.14913	21.7341	22.3192	6.00	30.00

Table 38. Quarter Completed: ANOVA and Homogeneity Results

		ANOVA					Homogeneity	
		Sum of Squares	df	Mean Square	F	Sig.	Levene Statistic	Sig.
Training	Between Groups	16.839	8	2.105	.523	.840	1.752	0.082
	Within Groups	5517.373	1370	4.027				
	Total	5534.212	1378					
Resources	Between Groups	236.325	8	29.541	1.633	.111	0.562	0.810
	Within Groups	24778.382	1370	18.086				
	Total	25014.706	1378					
Management	Between Groups	286.097	8	35.762	1.167	.315	1.783	0.076
	Within Groups	41973.756	1370	30.638				
	Total	42259.853	1378					

V Discussion

Overview

This final chapter will discuss the findings of this research and how those findings relate to the proposed research question. Investigative Question 1 will be answered by a brief discussion of EFA findings regarding the underlying structure of the AFCMRS survey. Investigative Question 2 will be answered by reviewing survey demographics and data used for trend analysis. Investigative Question 3 will be answered by translating one-way analysis of variance findings into existing trends within analyzed variables. Ultimately, the implications of research findings will be discussed, and future research proposed.

IQ1

What coherent safety climate (or other) constructs exist within the current nuclear maintenance Air Force Combined Mishap Reduction System survey data?

Exploratory Factor analysis indicated that three distinct factors existed in the underlying survey structure: Management Commitment, Resources, and Training. Internal consistency was validated using Cronbach's alpha with all factors exceeding the recommended minimum of .70: .906 for Management Commitment (6 items), .905 for Resources (4 items), and .720 for Training (3 items).

IQ2

What group variables exist, within the existing survey, which may provide a basis for analysis of safety trends within the nuclear maintenance enterprise?

Seven variables existed within the survey that proved suitable for means testing in search of trends, differences and similarities: Date Survey Completed, Rank, Missile Field Deployer Status, Age, Time in Career Field, Time in Unit, and Primary Weapon System.

IQ3

What trends, differences, or similarities, exist among the identified constructs and variables that may highlight existing trends useful for leadership situational awareness and decision making?

Notable differences existed within the variables of Rank, Age, Time in Career Field, and Time in Unit across all composite scores for Management

Discussion

"A survey can act as a basic intervention by leadership" (Carroll, 1998). While this statement may be true, why stop at a basic intervention when a survey can prove to be a valuable resource for leadership? This research uncovered three factors within the AFCMRS survey that can directly be attributed to, and measure, safety climate. With research supporting a correlation between safety climate and safety outcome (Choudhry et al., 2009; Morrow et al., 2014) the ability to measure safety climate can provide a potential predictive measure that leadership can use to reduce negative safety outcomes.

While this research stopped short of pontificating on the predictive possibilities of the measure, current trends and similarities were discovered that provide useful data to leaders at all levels.

Commitment, Resources, and Training. Similarities existed in group composite score comparisons for Missile Field Deployer Status and Primary Weapon system (with the exception of ICBM compared to Other perception of Resources). Potential trends were found when comparing perceptions of Management Commitment, Resources, and Training between groups for the variables of Rank, Age, Time in Unit, and Time in Career Field.

One notable similarity existed between groups for the Date Survey Taken variable. Analysis of variance between means for both "year taken" and "quarter taken" uncovered no significant difference in perception for all three factors. The data supports a level and unchanging view of safety (for better or worse) across four years of responses. Even with initiatives and commanders changing frequently throughout the data timeframe, it seems no positive or negative changes for safety climate existed.

Existing trends like this can inform commanders about how to appropriate time and effort to safety issues. For example, variations in perception across Rank, Age, Time in Unit, Time in Career Field created some unexpected trends. Examples of groups with statistically significant mean differences are shown in Figure 2 and Figure 3.

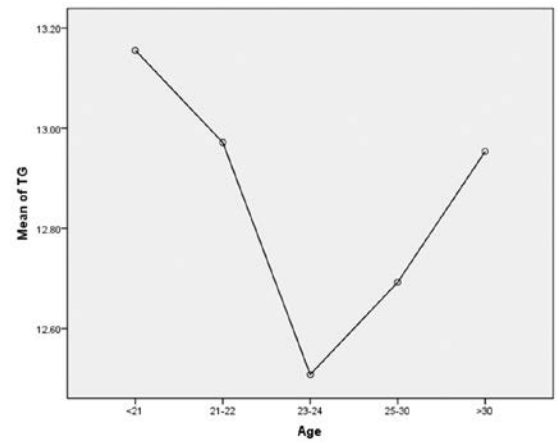

Figure 2. Mean Plot for Perception of Training across Age Groups

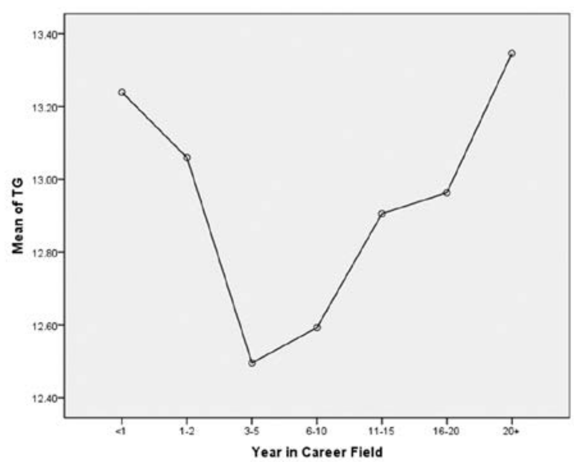

Figure 3. Mean Plot for Perception of Training across Years in Career Field Groups

The aforementioned variations support Slocum and Cron's (1985) findings regarding career stage theory. This theory, originally proposed by Donald E. Super (1958), suggests that three different career stages exists (Trial Stage, Maintenance Stage, and Stabilization Stage) and that employees at each career stage exhibits different tendencies (Slocum & Cron, 1985). Slocum and Cron's study (1985) positively supported Super's theory by finding career stage impacts attitudes and job behaviors while also postulating that person's in the trial stage (finding occupation and lifestyle satisfactory) are more likely to identify with the organization (Super, 1958 as cited by Slocum & Cron, 1985). When applied to the group variances discovered through ANOVA in the current study, the results suggest that the younger respondents (In Rank, Time in Career Field, Time in Unit, and Age) may be experiencing a similar phenomenon. Having just starting their career and having an obligation to serve a perfunctory period may increase their perceptions of Safety Climate merely due to their career stage.

While career stage theory explains differing perceptions among stages, combining relevant groups may assist in explaining trends within the data. While Rank, Age, and Time in Career were analyzed separately, they represent distinct groups within the maintenance community. For airmen, the ranks E1 through E3 are typically 18-21 years old and have less than three years' time in unit. At this stage in an airman's career the youngest have just graduated their respective technical training and have joined their first maintenance organization. On the opposite end of this group are airmen that are completing on the job training and becoming experts in their craft. These personnel are solely focused on perfecting their skills and are generally unconcerned with issues outside of that scope. This group of personnel is also under the first contractual obligation (three or six years) and is unable to search for alternate careers in the private sector. The status quo, coupled with pay and benefits, satisfies the youngest respondents. From a trend standpoint, perception of Management Commitment, Training, and Resources began to drop sharply as respondents progressed in rank, age, and experience.

The next career stage for enlisted personnel in the maintenance community combines two Year in Career groups (3-5, 6-10 years), one Rank group (E4-E6), and two Age groups (23-24 and 25-30), essentially representing the Noncommissioned Officer (NCO) demographic. Within this range, personnel enter the phase where they supervise personnel and portions of maintenance. Beginning as Team Chiefs and progressing to jobs such as Critical Task Supervisor, Site Supervisor, and Bay Chief, this personnel group experiences an increased load of responsibility. Instead of focusing simply on task performance they must now concern themselves with supervising subordinates, administrative issues (i.e. performance reports), and other non-maintenance activities (i.e. professional military education and additional duties).

In addition to this change in responsibility level, workers within this range are also completing their first contractual obligation and considering their career prospects and future. Coupled with the increased workload, these decisions arguably add additional pressure to the new supervisors. While these stressors can affect the ultimate perceptions of safety for NCOs (perceptions were statistically significantly different from both E1-E3 and E7-E8), it must also be assumed that, as first line supervisors, the E4-E6 group is in the best position to judge safety within the organization. Unlike the E7-E8, E9, and O4-O5 groups, the E4-E6 group directly performs and supervises maintenance actions. Due to their direct contact with younger airmen and exposure to maintenance activities, this group's perceptions must be strongly considered when measuring safety climate. The large disparity that exists between the first line supervision group and older management groups responsible for policy, resources, and training decisions is cause for concern.

The third enlisted group, Senior Noncommissioned Officers (SNCO) (E7-E8), aligns with the over 30 years old age group and 11-20 years' time in career field groups (a combination of 11-15 years and 16-20 years). As the enlisted group in management positions (leading sections, flights, and squadrons), this group is explicitly tasked with performing all three discovered components: managing personnel, training their subordinates, and appropriately allocating resources for mission accomplishment (USAF, 2009). With the group responsible for these functions partaking in the survey, they are essentially rating themselves. This would explain why these groups rated Management Commitment, Training, and Resources higher than first line supervisors. This is especially evident when comparing perception of Training across years in career field (see Figure *4*). As groups advance in years, so does their portion of responsibility for the three constructs discovered through this research. Data shows that composite scores for managers are higher than that of their subordinates, especially for Management Commitment and Training.

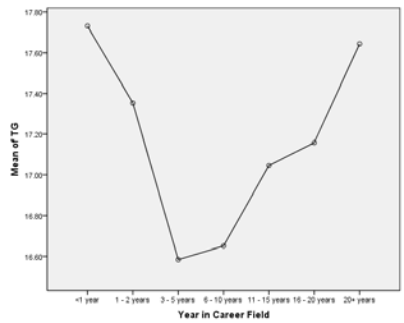

Figure 4. Mean Plot for Perception of Training
Across Year in Career Field Groups

The highest-level managers within the study consists of the Rank group O4-O5. Also known as Majors and Lieutenant Colonels, this group comprises squadron-level leadership. As Operations Officers and Squadron Commanders, this group is ultimately responsible for organization direction and mission accomplishment. More so than the SNCO group, they are tasked with managing the three components and, as such, the composite scores rise even further. O4-O5 groups rated perceptions exceptionally higher when compared to those actively engaged with safety in the work area. The imbalance between O4-O5 and E4-E6 is at its greatest for the Management Commitment factors (see Figure *5*) but also exists for the Training factor (see Figure *6*). Resources remains the only factor where the two groups do not significantly differ (see Figure *7*), and this similarity is equally insightful.

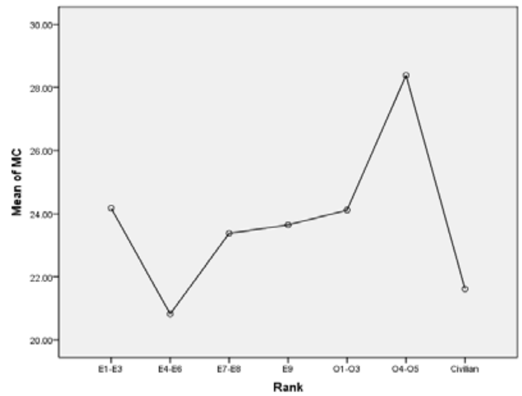

Figure 5. Mean Plot for Perception of Management Commitment Across Rank Groups

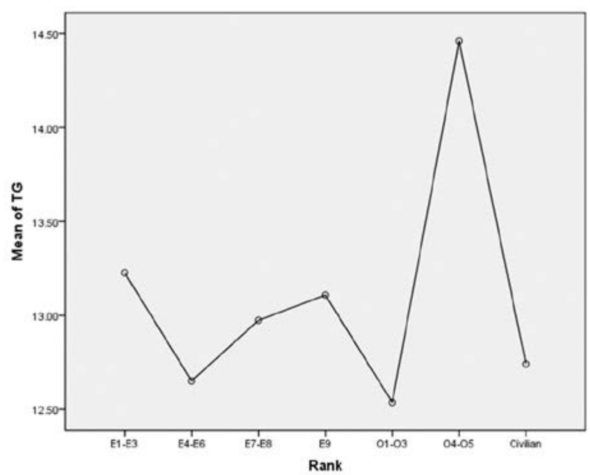

Figure 6. Mean Plot for Perception of Training across Rank Groups

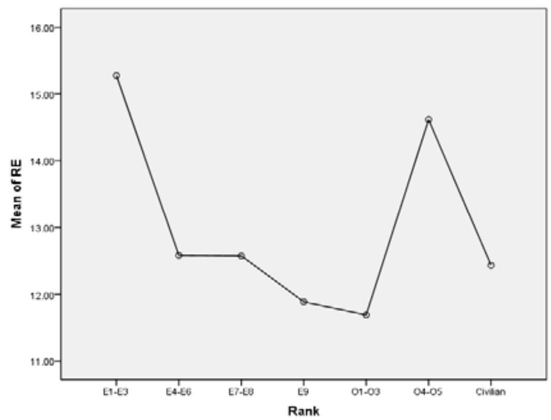

Figure 7. Mean Plot for Perception of Resources across Rank Groups

Perception of adequate resources is a frequent complaint within the Air Force. As resources are finite, it is not uncommon to blame lack of adequate resources for mission impediment. Having a maintenance background, the author has experienced countless meetings where lack of resources, a measure arguably beyond local control, is the culprit for mishaps. The composite score for Resources was inversely related to how old the respondents were (see Figure *8*) and how long they had spent in the unit (see Figure *9*). This negative trend supports the idea that leadership treats lack of resources as the offender as opposed to Management Commitment or Training. While this could be factual, conjecture could be made that leadership shifts responsibility by focusing on a construct beyond their control instead of accepting personal responsibility for safety climate.

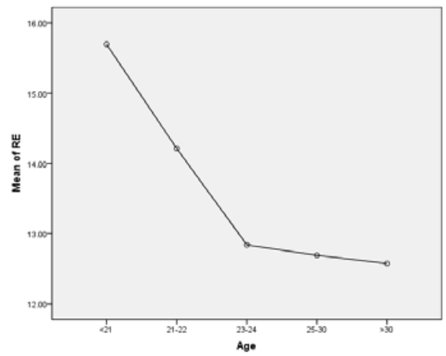

Figure 8. Mean Plot for Perception of Resources across Age Groups

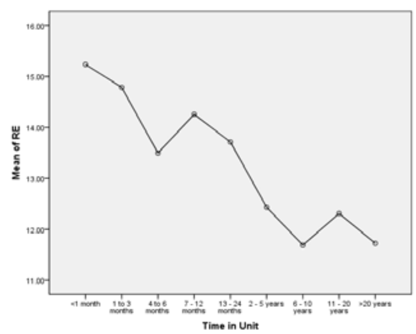

Figure 9. Mean Plot for Perception of Resources across Time in Unit Groups

Contrasting the findings of time-based variables, perceptions across weapon systems was stable with perception of resources identified as an outlier. When ICBM, Bomber, and Other were compared only the ICBM group and Other group differed with statistical significance. While recent incidents highlighted glaring safety issues within the nuclear enterprise, data does not appear to support a large disparity between perceptions.

Implications

The data gathered, analyzed and discussed ultimately answered the overall research question for this thesis. Knowing that three factors (with appropriate psychometric properties) exist within the AFCMRS survey data allows for a more thorough understanding of the results. Ultimately, a disconnect exists between leadership and the ranks performing hands on maintenance. This disparity may exist due to leadership being disconnected from day-to-day maintenance activities or it may exist because first-line supervisors are simply discontent with the requirements levied upon them. No matter the reasoning, the ultimate implication of this study is that leadership at all levels can be made aware of this trend.

With respect to resources, time, and initiatives the most progress may be made by focusing safety initiatives on the following groups: E4-E6, 23-24 years old, 3-10 years in career field, or 6-10 years' time in unit as they are the groups with the lowest composite scores across all constructs. Instead of a blanket approach to safety, emphasis can be placed in specific areas where it may prove to have the largest impact. More importantly, it isn't blanket safety talks that will improve climate. To improve perceptions, leaders will need to improve Management Commitment, Training, and Resources.

From the author's professional experience, Management Commitment, Training, and Resources tend to go hand-in-hand within a maintenance unit. If first-line supervisors don't feel properly supported with resources and training, perception of management commitment will ultimately suffer the consequences. This research identified a disillusioned group within the nuclear enterprise as opposed to simply comparing mean scores against other units.

With respect to weapon systems, virtually no differences were noted between weapon systems or missile field deployment status. While this may seem unexpected (since SECDEF-directed inquiries agreed with Burns & Baldor (2014) that missile field deployers reported higher levels of career dissatisfaction), responses between ICBM, Bomber, and Other career fields were not significantly different in respect to Training and Management commitment. The exception was the perception of Resources and this issue may be rectified by the increase in manning, spending, and improvement efforts instituted by SECDEF Hagel. Analysis of future survey responses utilizing this research's proposed three factor structure will identify whether these changes have any effect on measured perceptions on future surveys.

While current AFCMRS survey data can be measured and compared to sister squadrons, the owning command, and the Air Force as a whole, the measurement is not effective and the survey structure must be addressed. Ultimately, using statistical analysis, this study identified underlying trends worth noting that do not present under the current process. The most glaring finding is that a large disparity exists between leadership groups (O4-O5 ranks, 20+ years' time in career field , and over 30 years of age) and groups performing and directly supervising maintenance (E4-E5, 3-10 years' time in career, and 23-24 years of age). While only anecdotal attempts can be made to explain this difference it is vital to address.

Limitations

One limitation for this study revolved around data cleansing prior to performing Exploratory Factor Analysis. On 30 July 2013, the Air Force Safety Center released a change to the survey's structure (rewording 19 questions and adding the variable of Missile Field Deployer Status). Due to this change, 9,787 survey responses were eliminated from inclusion within this research. While the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy of .947 proved sample size more than adequate, survey demographics were drastically altered between the original survey demographics and the sample demographics utilized for analysis. Table 39 provides a comparison of original demographics to analyzed demographics.

For analysis, 20% of post-change survey responses were randomly selected. With the survey change, missing data removal, and uniform responses removed the representation of demographic groups was altered. Demographic changes to note (>1.5% change) include:

- E1-E3 was decreased from 23.4% to 21.3%
- E7-E8 was increased from 9.6% to 11.2%
- 1 to 3 months' time in unit increased from 3.1% to 7.3%
- 4 to 6 months' time in unit increased from 3.0% to 7.4%
- 7 to 12 months' time in unit decreased from 13.1% to 11.3%
- 13 to 24 months' time in unit decreased from 22.5% to 20.8%
- 2 to 5 years' time in unit increased from 36.5% to 38.5%
- Greater than 20 years' time in unit decreased from 7.1% to 0.4%
- 21-22 years of age decreased from 15.3% to 12.7%

- Over 30 years of age increased from 30.2% to 34.1%

While all statistical tests still support the adequacy of the findings, the demographics have changed and as such, need to be stated. Without questionnaire changes, future research may be able to provide a more accurate population sample post-conditioning.

Table 39. Analysis Demographics In Comparison to Original Population

Rank	Frequency (n)	Original Sample %	Analysis sample %
E1-E3	294	23.4%	21.3%
E4-E6	836	59.3%	60.4%
E7-E8	155	9.6%	11.2%
E9	15	0.9%	1.1%
O1-O3	40	2.4%	2.9%
O4-O5	13	0.9%	0.9%
Other	30	3.5%	2.2%

Time in Career (years)	Frequency	Original Sample %	Analysis sample %
<1	113	8.8%	8.2%
1-2	254	19.6%	18.4%
3-5	357	25.0%	25.8%
6-10	242	19.5%	17.5%
11-15	209	12.9%	15.1%
16-20	133	8.1%	9.6%
20+	75	6.2%	5.4%

Missile Field Deployer	Frequency	Original Sample %	Analysis sample %
Yes	190	6.8%	13.7%
No	1193	37.8%	86.3%

Primary Weapon System	Frequency	Original Sample %	Analysis sample %
ICBM	377	28.6%	27.3%
Bomber	877	56.9%	63.4%
Other	129	14.5%	9.3%

Time in Unit	Frequency	Original Sample %	Analysis sample %
<1 month	25	2.8%	1.8%
1 to 3 months	101	3.1%	7.3%
4 to 6 months	102	3.0%	7.4%
to 12 month	156	13.1%	11.3%
3 to 24 month	287	22.5%	20.8%
2 to 5 years	533	36.5%	38.5%
6 to 10 years	112	8.8%	8.1%
11 to 20 years	61	3.2%	4.4%
> 20 years	6	7.1%	0.4%

Age (years)	Frequency	Original Sample %	Analysis sample %
<21	124	9.9%	9.0%
21-22	176	15.3%	12.7%
23-24	214	15.4%	15.5%
25-30	398	29.2%	28.8%
>30	471	30.2%	34.1%

Note: Demographics represent AFCMRS Survey respondents that were randomly chosen for analysis.

Another limitation of this study is the original survey formatting and item content. The AFCMRS survey data is meant to be aligned with the HFACS model (AFSEC, n.d.-a) and relies on that model for question separation. The survey structure does not support this intent, instead, separating survey items into three subgroups to measure tier one and a fourth subgroup measuring all three tier two dimensions as a single dimension. Along with flawed structure, item wording was inadequate. 31 survey items were worded so as to measure multiple concepts. For example, question 40 ("I am provided adequate resources (e.g. time, staffing, budget, and equipment) to accomplish my job) asks respondents to provide one answer covering four facets of resources.

Statistically, EFA supports three factors and associated items, but 50 survey items were eliminated due to lack of psychometric adequacy. Elimination of questions due to wording and lack of cohesive constructs limits the ability to test for other important factors. With safety climate research supporting a plethora of alternate dimensions, better wording and organization of questions could lead to more identified factors and trends.

Future Research

With this research strongly supporting the developed three-factor structure, additional safety measures should be compared in search of similar factor structures. The Air Force Safety Center publishes 14 additional safety measures utilizing a structure based on the HFACS model (AFSEC, n.d.-a). The methodologies utilized in this research can be applied to other published measures in search of similarities (or differences) between measure structures.

Additional analysis of AFCMRS nuclear maintenance safety climate survey data can also be accomplished. With only 20% of survey data utilized by this research, Confirmatory Factor Analysis should be accomplished to further strengthen the three-factor structure. Further Exploratory Factor analysis may also be accomplished as this research's initial latent root criterion suggested a potential fourth factor.

Future research may also incorporate the possible predictive nature of safety climate measures (Choudhry et al., 2009; Morrow et al., 2014) by coupling this research with actual mishap data. The author recommends using mishap data from units participating in the AFCMRS nuclear maintenance safety climate survey and exploring the relationship between the factors identified and actual safety outcomes.

Conclusion

The intent of this study was to analyze current safety climate measurement devices in search of useful information regarding safety climate within the Air Force nuclear maintenance community. With three qualifiers of success (Identify measurable constructs, identify variables for trend analysis, and identify relationships between constructs and variable groups) this research met its purpose. A three-factor structure (Management Commitment, Training, and Resources) existed within the AFCMRS survey data and seven demographic variables provided insight into trends within the community. These findings support previous research regarding the existence of safety climate within organizations and provide a starting point for continuing research within the Air Force nuclear enterprise.

Appendix A: AFSEC Survey Questionnaire

Organizational Processes

1. In my squadron/organization, nuclear security is a key part of all operations.
2. My squadron/organization closely monitors PRP qualifications.
3. Personnel in my squadron/organization must possess the appropriate work experience and skills to receive qualifications.
4. Security education and training are adequate in my squadron/organization.
5. Maintenance records are correctly maintained, are accurate and controlled in my squadron/organization.
6. My training records are well maintained and accurate in my squadron/organization.
7. I am adequately trained to competently conduct my job.
8. My squadron/organization adequately monitors daily operations to catch possible human errors.
9. PRP certified individuals always notify their direct supervisors when they self-medicate for an illness.
10. PRP certified individuals notify their certifying officials and competent medical authority when they receive medical care anywhere other than at their assigned MTF.
11. In my squadron/organization, required tools and equipment are available and serviceable.
12. Tool control is closely monitored in my squadron/organization.
13. My squadron/organization makes effective use of the Competent Medical Authority (CMA) to help manage PRP personnel.
14. QA/QAE standards in my squadron/organization are clearly stated.
15. QA/QAE standards in my squadron/organization are enforced.
16. Our work performance when deployed is of the same quality as our work performance when at home base.
17. My squadron/organization adequately recognizes me or my subordinates for doing the correct procedures and maintenance activities.
18. MAJCOM recognition programs adequately recognize my squadron/organization for outstanding nuclear security practices.
19. In my squadron/organization, procedural guidance (AFIs, AFMANs, T.O.s, etc.) is available and current.
20. Official guidance (AFIs, AFMANs, T.O.s, etc.) and understanding of nuclear surety procedures directs day-to-day decisions in my squadron/organization.
21. Within my squadron/organization, effective communication exists up and down the chain of command.

22. My squadron/organization effectively communicates pertinent information during shift changes.

Organizational Climate

23. My squadron/organization is genuinely concerned about nuclear security.
24. In my squadron/organization, everyone is responsible/accountable for nuclear security.
25. Our squadron/organization environment promotes practices consistent with nuclear surety.
26. Active duty and Reserve component personnel have the same perceptions of the nuclear surety mission.
27. Peer influence discourages violations of AFI's/T.O.'s and nuclear security rules in my squadron/organization.
28. Violations of AFI's/T.O.'s are rare in my squadron/organization.
29. Squadron/organization members are encouraged to comply with standards when they accomplish their job/mission.
30. Duty shifts and rest period policies are enforced in my squadron/organization.
31. Individuals in my squadron/organization feel free to report PRP issues or security violations.
32. Members of my squadron/organization work effectively as a team.
33. Unprofessional behavior that compromises PRP standards is not tolerated in my squadron/organization.
34. Unit PRP monitor positions are sought after in my squadron/organization.
35. QA/QAE is a well respected element of my squadron/organization.
36. QA/QAE positions are sought after in my squadron/organization.
37. My squadron/organization has a reputation for high-quality performance.
38. Squadron/organization members understand, believe in, and feel committed to the nuclear mission.
39. Morale in my squadron/organization is outstanding.

Resources

40. I am provided adequate resources (e.g., time, staffing, budget, and equipment) to accomplish my job.
41. Day/Night crew has sufficient staffing to meet workload demands in my squadron/organization.
42. My squadron/organization has adequate personnel to perform its current tasks.
43. Nuclear mission training is rarely postponed/cancelled due to operational commitments in my squadron/organization.

44. Nuclear surety training is rarely postponed/cancelled due to support of non-nuclear mission requirements.
45. Multiple job assignments and additional duties are distributed in a manner which allows unit members to perform their primary jobs.
46. TDY deployment rates for the last year have **not** created safety problems in my squadron/organization.
47. Deployment for non-nuclear surety missions does **not** degrade mission effectiveness in my unit.
48. Day-to-day non-nuclear mission demands do **not** degrade mission effectiveness in my unit.
49. Our unit's operational demands allow members to obtain sufficient rest to perform their jobs.
50. Squadron/Organization members' life style, behavior, and judgment allow them to obtain sufficient rest to perform their jobs.
51. My squadron/organization has sufficient manning/assets to perform its current tasks.

Supervision

52. Leaders/Supervisors in my squadron/organization are actively engaged in the nuclear security program.
53. Leaders/Supervisors in my squadron/organization are successful in communicating mission goals to unit personnel.
54. Supervisors/QA routinely monitor maintenance activities in my squadron/organization.
55. Work center supervisors coordinate their actions in my squadron/organization.
56. Leaders/Supervisors' decisions are respected in my squadron/organization.
57. Leaders/Supervisors in my squadron/organization care for both members' quality of life and mission accomplishment.
58. Leaders/Supervisors in my squadron/organization can be trusted.
59. Leaders/Supervisors in my squadron/organization react well to unexpected changes.
60. Leaders/Supervisors in my squadron/organization set the example for compliance with policy, rules, and instructions.
61. Leaders/Supervisors in my squadron discourage cutting corners to get a job done.
62. Supervisors encourage members in my squadron/organization to always complete work actions before signing off.
63. Leadership in my squadron/organization encourages personnel to report incidents/accidents.

Open-ended response items

64. The most significant action(s) my squadron can take to improve Nuclear Surety is(are):
65. Use this space to provide any concern that you would like to comment upon.

Appendix B: Dimensions Found in Safety Literature and Redefinition for Study

Listed Dimension	Occurences	Redifined as	
accountability	1	Active supervisory practices	
active practices	2	Active supervisory practices	
activities	1	Unassigned	
appreciation of safety work	1	Status of Safety	Management attitude
attitude toward safety in the org	1	Status of Safety	Management attitude
attitude toward safety within the group	1	Status of Safety	Management attitude
attitudes	1	Management attitude	
blame	1	Management Action	
cell phone disapproval	1	Unassigned	
clarity of safety rules	1	Communication	Training
Communication	2	Communication	
communication about safety	1	Communication	
company policy	1	Management action	
competence	1	Training	
Confidence in safety procedures	1	Percieved Risk	Equipment & Facilities
conflict/control	1	Unassigned	
control of safety	1	Percieved Risk	
controls of risk	1	Percieved Risk	
declarative practices	2	Management attitude	
delivery limits	1	Unassigned	
design	1	Percieved Risk	
driver safety priority	1	Percieved Risk	
effect of safe conduct on social status	1	Status of Safety	Management attitude
effect of safety on promotion	1	Status of Safety	Management attitude
effect of work pace on safety	2	Safety v production	
effects of safe conduct on promotion	1	Status of Safety	Management attitude
effects of safe conduct on social status and promotion (rewarding safety)	1	Status of Safety	Management attitude
Employee perception of how concerned management is	1	Management action	
enactive	1	Management actions	
encouragement/discipline for safety	1	Active supervisory practices	Management Actions
equipment/maintenance	1	Equipment & Facilities	
feedback on safety	1	Communication	
Field Orientation (experience, communication, decision making)	1	Training	Communication
Financial investment	1	Management Action	Equipment & Facilities
formal rules and procedures	1	Management actions	
General Training	1	Training	
global self safety	1	Unassigned	
group attitudes	1	Percieved Risk	
how actively does management respond to concerns	1	Management action	
importance of safety training	1	Training	
importance of safety training program	1	Training	
importance of training	2	Training	
Individual responsibility	1	Unassigned	
Influence of safety legislation	1	Management actions	
knowledge	1	Training	
level of risk	3	Percieved Risk	
maintenance and management issues	1	Management Action	Equipment & Facilities
management actions	1	Management Action	

Listed Dimension	Occurences	Redifined as	
management actions toward safety	2	Management Action	
Management activity	1	Management Action	
Management attitude toward safety	4	Management attitude	
management attitudes	1	Management attitude	
Management commitment	3	Management action	
management commitment to safety	1	Management action	
Management Concern	2	Management attitude	
management enforcement	1	Management action	
Management involvment	1	Management action	
management knowledge	1	Management Action	Training
Management satisfation	1	Management attitude	
management support (meetings/hardware)	1	Management action	
management values	1	Management attitude	
Manager emphasis on safety	1	Management action	
manager support	1	Management action	
management encouragement/support	1	Management action	
monitoring and control	1	Active supervisory practices	
need for safety	1	Percieved Risk	
openness	1	Communication	
Organizational Support	1	Management action	
participation	1	Active supervisory practices	
Participation encouragement (ensuring PPE iw worn, getting buy-in)	1	Active supervisory practices	
People	1	Unassigned	
percieved risk	3	Percieved Risk	
personal authroity	1	Percieved Risk	
personal immunity	1	Unassigned	
personal management contact	1	Active supervisory practices	
personnel safety training	1	Training	
physical work environment	1	Percieved Risk	Equipment & Facilities
policy/procedures	1	Management action	
prevention strategies	1	Active supervisory practices	
Proactive practices	3	Active supervisory practices	
production as priority	1	Safety v production	
production v safety	1	Safety v production	
promoting learning/improvement	1	Training	Active supervisory practices
rewards for good work	1	Management actions	
risk	3	Percieved Risk	
risk level	3	Percieved Risk	
risk perception	2	Percieved Risk	
rules/regs	1	Management action	
safety arrangements	1	Management actions	
safety as part of productive work	1	Safety v production	
safety as priority	1	Safety v production	
safety attitudes	1	Management attitude	
safety coaching	1	Active supervisory practices	
safety communication	3	Communication	
safety engagement	1	Active supervisory practices	
safety level	2	Percieved Risk	

Listed Dimension	Occurences	Redifined as	
safety measures	1	Management actions	Active supervisory practices
safety officer/promotion/training/committee	1	Status of Safety	Management attitude
safety policy	1	Management action	
Safety pro-activity	1	Active supervisory practices	
safety procedures	1	Management actions	Active supervisory practices
Safety promotion	1	Communication	
safety rep status	1	Status of Safety	Management attitude
safety representative authority	1	Status of Safety	Management attitude
safety rules	1	Management actions	Active supervisory practices
Safety Straight Talk	1	Communication	
safety systems	3	Equipment & Facilities	
Safety training	2	Training	
Safety v competing goals	1	Safety v production	
safety v production	1	Safety v production	
satisfaction with training	1	Training	
Schedule Flexibility	1	Unassigned	
sharing safety values	1	Active supervisory practices	
site management	1	Management Actions	Management Attitude
speaking up	1	Communication	
status of safety and social status/promotion	1	Status of Safety	Management Attitude
status of safety committee	1	Status of Safety	Management Attitude
status of safety officer	2	Status of Safety	Management Attitude
status of safety officer/committee	2	Status of Safety	Management Attitude
supervisor encouragement/support	1	Active supervisory practices	
supervisor enforcement	2	Active supervisory practices	
supervisor involvement	1	Active supervisory practices	
supervisor knowledge	1	Training	Active supervisory practices
supervisor satisfaction	1	Management Attitude	
Supervisor support	1	Active supervisory practices	
supervisors	1	Active supervisory practices	
supervisory action	1	Active supervisory practices	
Supervisory care (emotional intelligence, feedback, communication)	2	Active supervisory practices	
supervisory expectation	1	Active supervisory practices	
supportive environment	1	Active supervisory practices	Status of Safety
training	2	Training	
training and enforcement of policy	1	Training	Active supervisory practices
training and management issues	1	Training	Management Action
Trucks and Equipment	1	Equipment & Facilities	
violations	1	Percieved Risk	
work clarity	1	Communication	
work conditions	1	Percieved Risk	
work environment	1	Equipment & Facilities	Percieved Risk
work place	1	Equipment & Facilities	Percieved Risk
work practices	1	Percieved Risk	
work presssure (safety v production)	2	Safety v production	
Worker involvement in safety process	2	Active supervisory practices	

Appendix C: AFCMRS Measures selected for validation

3	Personnel in my squadron/organization must possess the appropriate work experience and skills to receive qualifications
6	My training records are well maintained and accurate in my squadron/organization
7	I am adequately trained to competently conduct my job
8	My squadron/organization adequately monitors daily operations to catch possible human errors
11	In my squadron/organization, required tools and equipment are available and serviceable
12	Tool control is closely monitored in my squadron/organization
14	QA/QAE standards in my squadron/organization are clearly stated
15	QA/QAE standards in my squadron/organization are enforced
16	Our work performance when deployed is of the same quality as our work performance when at home base
17	My squadron/organization adequately recognizes me or my subordinates for doing the correct procedures and maintenance activities
19	In my squadron/organization, procedural guidance (AFIs, AFMANs, T.O.s, etc.) is available and current
20	Official guidance (AFIs, AFMANs, T.O.s, etc.) and understanding of nuclear surety procedures directs day-to-day decisions in my squadron/organization
21	Within my squadron/organization, effective communication exists up and down the chain of command
22	My squadron/organization effectively communicates pertinent information during shift changes
25	Our squadron/organization environment promotes practices consistent with nuclear surety
26	Active duty and Reserve component personnel have the same perceptions of the nuclear surety mission
27	Peer influence discourages violations of AFI's/T.O.'s and nuclear security rules in my squadron/organization

28	Violations of AFI's/T.O.'s are rare in my squadron/organization
29	Squadron/organization members are encouraged to comply with standards when they accomplish their job/mission
30	Duty shifts and rest period policies are enforced in my squadron/organization
31	Individuals in my squadron/organization feel free to report PRP issues or security violations
32	Members of my squadron/organization work effectively as a team
33	Unprofessional behavior that compromises PRP standards is not tolerated in my squadron/organization
34	Unit PRP monitor positions are sought after in my squadron/organization
35	QA/QAE is a well-respected element of my squadron/organization
36	QA/QAE positions are sought after in my squadron/organization
37	My squadron/organization has a reputation for high-quality performance
38	Squadron/organization members understand, believe in, and feel committed to the nuclear mission
39	Morale in my squadron/organization is outstanding
40	I am provided adequate resources (e.g., time, staffing, budget, and equipment) to accomplish my job
41	Day/Night crew has sufficient staffing to meet workload demands in my squadron/organization
42	My squadron/organization has adequate personnel to perform its current tasks
43	Nuclear mission training is rarely postponed/cancelled due to operational commitments in my squadron/organization
44	Nuclear surety training is rarely postponed/cancelled due to support of non-nuclear mission requirements
45	Multiple job assignments and additional duties are distributed in a manner which allows unit members to perform their primary jobs
46	TDY deployment rates for the last year have **<u>not</u>** created safety problems in my squadron/organization

47	Deployment for non-nuclear surety missions does **not** degrade mission effectiveness in my unit
48	Day-to-day non-nuclear mission demands do **not** degrade mission effectiveness in my unit
49	Our unit's operational demands allow members to obtain sufficient rest to perform their jobs
50	Squadron/Organization members' life style, behavior, and judgment allow them to obtain sufficient rest to perform their jobs
51	My squadron/organization has sufficient manning/assets to perform its current tasks
52	Leaders/Supervisors in my squadron/organization are actively engaged in the nuclear security program
53	Leaders/Supervisors in my squadron/organization are successful in communicating mission goals to unit personnel
54	Supervisors/QA routinely monitor maintenance activities in my squadron/organization
55	Work center supervisors coordinate their actions in my squadron/organization
56	Leaders/Supervisors' decisions are respected in my squadron/organization
57	Leaders/Supervisors in my squadron/organization care for both members' quality of life and mission accomplishment
58	Leaders/Supervisors in my squadron/organization can be trusted
59	Leaders/Supervisors in my squadron/organization react well to unexpected changes
60	Leaders/Supervisors in my squadron/organization set the example for compliance with policy, rules, and instructions
61	Leaders/Supervisors in my squadron discourage cutting corners to get a job done
62	Supervisors encourage members in my squadron/organization to always complete work actions before signing off
63	Leadership in my squadron/organization encourages personnel to report incidents/accidents

Appendix D: Data Validation Exercise Instructions

AFCMRS Dimension Validation Exercise

Introduction:

Good afternoon,

I am Capt Clements and this exercise is the next step in the continuation of my graduate thesis work. I appreciate you taking the time to assist in this important work. As I read the instructions for this exercise, please take the time to enjoy the provided doughnuts.

Motivation:

The exercise today will consist of a matching exercise between a 53-item safety climate measure and 9 proposed dimensions drawn from thesis research. This exercise will ensure that the proposed dimensions have necessary levels of validity, and may be used for further analysis

Disclaimer:

This exercise is anonymous and no personal information will be gathered. Answers provided by participants are non-attributional. Information gathered will be used only within the scope of the author's graduate thesis.

Instructions:

This exercise is expected to take no longer than one hour. If you need to take a break, please feel free to do so of your own accord.

First, you will receive a single page of nine proposed dimensions for research. These dimensions have been drawn from literature relevant to the author's thesis topic. Please read the items, along with their definitions, and let me know if you have any questions regarding content or concepts.

[Provide definition sheet]

[Field Questions]

If everyone is comfortable with the definitions, I will now hand out the next portion of the exercise. Each participant will receive one copy of a 53-item safety climate measure. These 53 items were derived from the Air Force Combined Mishap Reduction System survey. The items listed were deemed relevant to the author's study, and additional items were removed if considered irrelevant. Additionally, order of questions was generated at random. You will receive a copy labeled as either Form 1 or Form 2. This label is for the researcher's purpose only and both copies of the exercise are composed of identical questions.

[Provide question bank]

Please read each item carefully and consider which dimension on the definition sheet that would apply to that item. All items are based on survey participant perception, so think of how each item listed would be linked to each perception.

When answering, please write answers in the blank space to the right of each item. Answers should be in the form of the two-letter identifier to the left of each dimension definition.

The answer that you should provide should be the best answer. If you feel that multiple dimensions may apply, please choose the one that you feel <u>best</u> relates.

To clarify key terms:

- "Management" refers to the leader(s) within an organization that have the power to make policy, but do not directly supervise line-workers. In the context of a squadron this would include the squadron commander
- "Supervisors" refers to the leader(s) within an organization that are responsible for enacting and translating policy into practice. In the context of a squadron this would include first-line supervisors.

If at any point you have a question, please feel free to ask the administrator. All questions, unless specifically requested by the participant inquiring, will have the answer provided to the group as a whole. Any feedback relating to the exercise is appreciated. Examples include, but are not limited to: exercise format, item ambiguity, definition ambiguity, overlapping concepts, etc.

You may begin the exercise at this time.

Appendix E: Validation Test Definition Sheet

DEFINITION SHEET

(MA) Management Attitude: Perception of how management views safety (Declaratory policy, encouraging safe practices, and safety values)

(MB) Management Action: Perception of actions taken by management. (Formal policy, rewarding/punishing, and support for safety)

(SP) Safety vs. Production: Perception of the importance of safety in regard to other organizational goals like production

(RE) Resources: Perception of adequacy and functionality of resources necessary for safety (manpower, equipment, facilities)

(SS) Status of Safety: Perception of importance placed on entities enforcing safety policies (Quality Assurance, safety officers, safety committees, and other positions ensuring safety standards are observed)

(CM) Communication: Perception of effectiveness of communication regarding safety (both upwards and downward)

(TG) Training: Perception of the importance and efficacy of safety training

(AS) Active Supervisory Practice: Perception of first-line supervisory involvement and influence on safety procedures and practices

(PR) Perceived risk: Perception of risk level within the organization and adequacy of safety systems

Appendix F: Test Bank 1

Day/Night crew has sufficient staffing to meet workload demands in my squadron/organization	
My squadron/organization adequately monitors daily operations to catch possible human errors	
Unprofessional behavior that compromises PRP standards is not tolerated in my squadron/organization	
Squadron/organization members understand, believe in, and feel committed to the nuclear mission	
QA/QAE standards in my squadron/organization are clearly stated	
Leaders/Supervisors' decisions are respected in my squadron/organization	
Peer influence discourages violations of AFI's/T.O.'s and nuclear security rules in my squadron/organization	
Squadron/Organization members' life style, behavior, and judgment allow them to obtain sufficient rest to perform their jobs	
Active duty and Reserve component personnel have the same perceptions of the nuclear surety mission	
Our work performance when deployed is of the same quality as our work performance when at home base	
Leadership in my squadron/organization encourages personnel to report incidents/accidents	
Leaders/Supervisors in my squadron/organization can be trusted	
Deployment for non-nuclear surety missions does **not** degrade mission effectiveness in my unit	
Nuclear mission training is rarely postponed/cancelled due to operational commitments in my squadron/organization	
My training records are well maintained and accurate in my squadron/organization	
My squadron/organization effectively communicates pertinent information during shift changes	
Leaders/Supervisors in my squadron/organization are actively engaged in the nuclear security program	

Leaders/Supervisors in my squadron/organization care for both members' quality of life and mission accomplishment	
Duty shifts and rest period policies are enforced in my squadron/organization	
Work center supervisors coordinate their actions in my squadron/organization	
Tool control is closely monitored in my squadron/organization	
Day-to-day non-nuclear mission demands do **not** degrade mission effectiveness in my unit	
Leaders/Supervisors in my squadron/organization set the example for compliance with policy, rules, and instructions	
Violations of AFI's/T.O.'s are rare in my squadron/organization	
Leaders/Supervisors in my squadron/organization are successful in communicating mission goals to unit personnel	
Morale in my squadron/organization is outstanding	
Leaders/Supervisors in my squadron/organization react well to unexpected changes	
I am provided adequate resources (e.g., time, staffing, budget, and equipment) to accomplish my job	
I am adequately trained to competently conduct my job.	
QA/QAE positions are sought after in my squadron/organization	
Nuclear surety training is rarely postponed/cancelled due to support of non-nuclear mission requirements	
Individuals in my squadron/organization feel free to report PRP issues or security violations	
In my squadron/organization, procedural guidance (AFIs, AFMANs, T.O.s, etc.) is available and current	
My squadron/organization has adequate personnel to perform its current tasks	
Our squadron/organization environment promotes practices consistent with nuclear surety	
QA/QAE is a well-respected element of my squadron/organization	
In my squadron/organization, required tools and equipment are available and serviceable	
Multiple job assignments and additional duties are distributed in a manner which allows unit members to perform their primary jobs	

Supervisors encourage members in my squadron/organization to always complete work actions before signing off	
Official guidance (AFIs, AFMANs, T.O.s, etc.) and understanding of nuclear surety procedures directs day-to-day decisions in my squadron/organization.	
Unit PRP monitor positions are sought after in my squadron/organization	
Squadron/organization members are encouraged to comply with standards when they accomplish their job/mission	
Personnel in my squadron/organization must possess the appropriate work experience and skills to receive qualifications	
My squadron/organization has a reputation for high-quality performance	
Leaders/Supervisors in my squadron discourage cutting corners to get a job done	
TDY deployment rates for the last year have **not** created safety problems in my squadron/organization	
My squadron/organization adequately recognizes me or my subordinates for doing the correct procedures and maintenance activities	
My squadron/organization has sufficient manning/assets to perform its current tasks	
Members of my squadron/organization work effectively as a team	
Within my squadron/organization, effective communication exists up and down the chain of command	
Our unit's operational demands allow members to obtain sufficient rest to perform their jobs	
Supervisors/QA routinely monitor maintenance activities in my squadron/organization	
QA/QAE standards in my squadron/organization are enforced	

Appendix G: Test Bank 2

My squadron/organization adequately recognizes me or my subordinates for doing the correct procedures and maintenance activities	
In my squadron/organization, procedural guidance (AFIs, AFMANs, T.O.s, etc.) is available and current	
Active duty and Reserve component personnel have the same perceptions of the nuclear surety mission	
Squadron/Organization members' life style, behavior, and judgment allow them to obtain sufficient rest to perform their jobs	
Our unit's operational demands allow members to obtain sufficient rest to perform their jobs	
Day/Night crew has sufficient staffing to meet workload demands in my squadron/organization	
Work center supervisors coordinate their actions in my squadron/organization	
Our work performance when deployed is of the same quality as our work performance when at home base	
Official guidance (AFIs, AFMANs, T.O.s, etc.) and understanding of nuclear surety procedures directs day-to-day decisions in my squadron/organization.	
Supervisors encourage members in my squadron/organization to always complete work actions before signing off	
Personnel in my squadron/organization must possess the appropriate work experience and skills to receive qualifications	
Leaders/Supervisors in my squadron/organization care for both members' quality of life and mission accomplishment	
Leaders/Supervisors in my squadron/organization are successful in communicating mission goals to unit personnel	
Violations of AFI's/T.O.'s are rare in my squadron/organization	
My training records are well maintained and accurate in my squadron/organization	
Leadership in my squadron/organization encourages personnel to report incidents/accidents	
QA/QAE is a well-respected element of my squadron/organization	

QA/QAE standards in my squadron/organization are clearly stated	
Leaders/Supervisors in my squadron discourage cutting corners to get a job done	
I am provided adequate resources (e.g., time, staffing, budget, and equipment) to accomplish my job	
My squadron/organization has adequate personnel to perform its current tasks	
Leaders/Supervisors in my squadron/organization are actively engaged in the nuclear security program	
Multiple job assignments and additional duties are distributed in a manner which allows unit members to perform their primary jobs	
My squadron/organization adequately monitors daily operations to catch possible human errors	
My squadron/organization effectively communicates pertinent information during shift changes	
Members of my squadron/organization work effectively as a team	
Nuclear mission training is rarely postponed/cancelled due to operational commitments in my squadron/organization	
Duty shifts and rest period policies are enforced in my squadron/organization	
Nuclear surety training is rarely postponed/cancelled due to support of non-nuclear mission requirements	
In my squadron/organization, required tools and equipment are available and serviceable	
Individuals in my squadron/organization feel free to report PRP issues or security violations	
Squadron/organization members are encouraged to comply with standards when they accomplish their job/mission	
My squadron/organization has sufficient manning/assets to perform its current tasks	
Leaders/Supervisors in my squadron/organization can be trusted	
Leaders/Supervisors in my squadron/organization react well to unexpected changes	
TDY deployment rates for the last year have **not** created safety problems in my squadron/organization	

Our squadron/organization environment promotes practices consistent with nuclear surety	
Within my squadron/organization, effective communication exists up and down the chain of command	
QA/QAE positions are sought after in my squadron/organization	
Unprofessional behavior that compromises PRP standards is not tolerated in my squadron/organization	
Unit PRP monitor positions are sought after in my squadron/organization	
Leaders/Supervisors in my squadron/organization set the example for compliance with policy, rules, and instructions	
Deployment for non-nuclear surety missions does **not** degrade mission effectiveness in my unit	
I am adequately trained to competently conduct my job.	
Supervisors/QA routinely monitor maintenance activities in my squadron/organization	
Peer influence discourages violations of AFI's/T.O.'s and nuclear security rules in my squadron/organization	
Leaders/Supervisors' decisions are respected in my squadron/organization	
Day-to-day non-nuclear mission demands do **not** degrade mission effectiveness in my unit	
QA/QAE standards in my squadron/organization are enforced	
Tool control is closely monitored in my squadron/organization	
Morale in my squadron/organization is outstanding	
My squadron/organization has a reputation for high-quality performance	
Squadron/organization members understand, believe in, and feel committed to the nuclear mission	

Appendix H: EFA Respecification Varimax Rotated Component Matrices

Rotated Component Matrixa

Run 1	Component			Communalities
	1	2	3	
NSMX_3	.273	.173	.687	.577
NSMX_6	.182	.212	.723	.600
NSMX_7	.115	.133	.725	.557
NSMX_8	.364	.192	.676	.626
NSMX_11	.184	.541	.435	.515
NSMX_17	.553	.369	.311	.539
NSMX_21	.619	.418	.290	.642
NSMX_22	.579	.370	.312	.569
NSMX_33	.503	.034	.566	.574
NSMX_35	.630	.275	.154	.496
NSMX_36	.578	.179	.091	.375
NSMX_40	.327	.745	.227	.714
NSMX_41	.275	.807	.142	.747
NSMX_42	.217	.860	.097	.797
NSMX_51	.244	.832	.092	.760
NSMX_53	.709	.275	.287	.661
NSMX_57	.716	.338	.246	.687
NSMX_59	.701	.330	.224	.651
NSMX_62	.577	.062	.483	.570
NSMX_63	.605	.037	.488	.605

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization

Rotated Component Matrixa

Run 2	Component			Communalities
	1	2	3	
NSMX_3	.316	.164	.658	.559
NSMX_6	.186	.216	.727	.610
NSMX_7	.111	.140	.738	.576
NSMX_8	.374	.195	.671	.628
NSMX_11	.205	.537	.421	.507
NSMX_17	.605	.355	.261	.560
NSMX_21	.682	.399	.227	.677
NSMX_22	.646	.351	.249	.602
NSMX_33	.512	.038	.559	.576
NSMX_35	.463	.335	.272	.400
NSMX_40	.321	.749	.226	.715
NSMX_41	.272	.809	.139	.748
NSMX_42	.203	.866	.103	.803
NSMX_51	.239	.835	.091	.762
NSMX_53	.748	.268	.246	.691
NSMX_57	.759	.328	.199	.724
NSMX_59	.742	.321	.178	.686
NSMX_62	.582	.068	.478	.572
NSMX_63	.605	.044	.485	.603

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization

Rotated Component Matrixa

Run 3	nt			Communalities
	1	2	3	
NSMX_3	.315	.166	.659	.561
NSMX_6	.180	.216	.728	.609
NSMX_7	.106	.140	.738	.575
NSMX_8	.367	.196	.674	.627
NSMX_11	.198	.537	.423	.507
NSMX_17	.602	.358	.266	.561
NSMX_21	.684	.403	.231	.683
NSMX_22	.648	.354	.253	.610
NSMX_33	.507	.041	.564	.577
NSMX_40	.316	.751	.230	.716
NSMX_41	.270	.811	.141	.751
NSMX_42	.198	.868	.106	.803
NSMX_51	.235	.836	.094	.764
NSMX_53	.745	.271	.252	.691
NSMX_57	.759	.332	.205	.728
NSMX_59	.743	.324	.184	.691
NSMX_62	.576	.071	.485	.572
NSMX_63	.599	.047	.492	.603

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization

Rotated Component Matrixa

Run 4	Component			Communalities
	1	2	3	
NSMX_3	.338	.139	.666	.578
NSMX_6	.203	.194	.735	.618
NSMX_7	.131	.115	.748	.590
NSMX_8	.385	.178	.670	.629
NSMX_11	.219	.516	.441	.509
NSMX_17	.618	.334	.271	.566
NSMX_21	.699	.379	.235	.688
NSMX_22	.661	.335	.252	.613
NSMX_40	.329	.745	.234	.717
NSMX_41	.279	.812	.143	.757
NSMX_42	.205	.873	.107	.816
NSMX_51	.242	.840	.095	.774
NSMX_53	.755	.256	.241	.693
NSMX_57	.770	.315	.199	.732
NSMX_59	.755	.306	.181	.696
NSMX_62	.582	.070	.458	.553
NSMX_63	.606	.044	.466	.586

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization

Rotated Component Matrixa

Run 5	Component			Communalities
	1	2	3	
NSMX_3	.363	.120	.647	.565
NSMX_6	.204	.197	.744	.634
NSMX_7	.110	.134	.778	.635
NSMX_8	.396	.169	.666	.628
NSMX_17	.650	.305	.242	.574
NSMX_21	.723	.356	.214	.695
NSMX_22	.677	.319	.239	.618
NSMX_40	.356	.726	.219	.702
NSMX_41	.282	.817	.157	.771
NSMX_42	.200	.887	.131	.844
NSMX_51	.241	.849	.113	.791
NSMX_53	.743	.258	.255	.683
NSMX_57	.765	.311	.207	.724
NSMX_59	.748	.303	.189	.687
NSMX_62	.578	.063	.462	.551
NSMX_63	.602	.036	.469	.583

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization

Rotated Component Matrixa

Run 6	Component			Communalities
	1	2	3	
NSMX_3	.368	.101	.658	.578
NSMX_6	.210	.183	.751	.641
NSMX_7	.114	.122	.786	.646
NSMX_8	.396	.156	.675	.636
NSMX_17	.673	.271	.257	.592
NSMX_21	.754	.312	.234	.721
NSMX_22	.698	.286	.253	.633
NSMX_40	.368	.722	.219	.704
NSMX_41	.292	.818	.154	.778
NSMX_42	.211	.891	.126	.855
NSMX_51	.255	.848	.111	.797
NSMX_53	.747	.239	.269	.687
NSMX_57	.771	.291	.220	.728
NSMX_59	.756	.281	.203	.693
NSMX_63	.546	.073	.458	.513

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization

Rotated Component Matrixa

Run 7	Component			Communalities
	1	2	3	
NSMX_3	.373	.090	.664	.588
NSMX_6	.218	.171	.757	.650
NSMX_7	.114	.120	.789	.649
NSMX_8	.398	.149	.678	.640
NSMX_17	.688	.249	.268	.607
NSMX_21	.774	.286	.249	.743
NSMX_22	.711	.266	.262	.645
NSMX_40	.374	.719	.219	.705
NSMX_41	.300	.816	.152	.779
NSMX_42	.220	.891	.125	.857
NSMX_51	.264	.846	.111	.798
NSMX_53	.742	.236	.267	.678
NSMX_57	.770	.285	.221	.723
NSMX_59	.758	.273	.207	.692

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization

Rotated Component Matrixa

Final Run	Component			Communalities
	1	2	3	
NSMX_3			.656	.599
NSMX_6			.756	.664
NSMX_7			.820	.706
NSMX_17	.696			.610
NSMX_21	.782			.744
NSMX_22	.721			.645
NSMX_40		.719		.705
NSMX_41		.817		.779
NSMX_42		.892		.858
NSMX_51		.847		.798
NSMX_53	.753			.679
NSMX_57	.778			.723
NSMX_59	.766			.693

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Factor Loadings < .4 are suppressed

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14. ABSTRACT

By possessing nuclear weapons, the United States Air Force is inherently exposed to extreme safety concerns. With multiple setbacks in recent years (e.g., unauthorized transport of nuclear weapons, cheating scandals, and career dissatisfaction), some have begun to wonder how safe the nuclear enterprise truly is. Building upon the concept of safety climate, this study explores safety climate constructs and trends associated with current nuclear maintenance safety climate survey data.

First, exploratory factor analysis is used to explore the underlying psychometric structure of the nuclear maintenance Air Force Combined Mishap Reduction System survey. Next, constructs extracted from the survey are compared across demographic variables in search of safety trends within the nuclear enterprise. Results confirm that a three-factor structure exists within survey data (consisting of Management Commitment, Resources, and Training constructs), and that differences in perceptions of these constructs exist across five of the seven explored variables (i.e., deployment to the intercontinental ballistic missile fields, rank, age, time in unit, and time in career field). Recommendations based on the findings are presented for leadership contemplation and action.

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